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THE CONDOR

VOLUME 56 JULY-AUGUST, 1954 NUMBER 4

PROBLEMS OF INCUBATION PERIODS IN NORTH AMERICAN BIRDS

By MARGARET MORSE NICE

Considerable confusion exists in North America on the subject of incubation periods in birds. There is little agreement on definition of the period and many writers seem to have no appreciation of the biological processes involved in incubation. All too many people are content to copy a figure for the incubation period out of a book or article that gives no indication of how this figure was determined, even in cases where it is strikingly inconsistent with the periods established for close relatives of the species in question. Too short periods are usually attributed to hawks and owls, as well as to some shorebirds, rails, terns, hummingbirds, and cowbirds, and too long periods are often attributed to woodpeckers, cuckoos, and some passerines.

Now that a handbook of North American birds is in preparation, it is time to make a thorough investigation of this fundamental subject and to trace the sources from which incubation periods in North America are quoted. Where these can be shown to have been based on guess, clearly they should be discarded. My searching on this subject has been carried out chiefly in the Chicago Natural History Museum and the John Crerar Library. I am much indebted to Louise de Kiriline Lawrence for suggestions on the manuscript.

DEFINITION OF INCUBATION PERIOD

What do we mean by incubation period? In some cases it has been considered the time the parent sits on the eggs. In some it is reckoned from the laying of the first egg of the set until its hatching, in others from the laying of the last egg to the hatching of the first, and in still others no explanation is offered as to what is meant.

In his interesting paper on this subject, Swanberg (1950) points out that it has been known for two centuries that pigeons may sit on the first egg without applying warmth to it (Moore, 1735). He quotes Ryves (1943) as follows: "Incubation . . . is the operation by which the eggs are subjected to the requisite temperature to permit their development." Swanberg then concludes (p. 75) that for the sake of uniformity we ought to adopt and remember Heinroth's (1922) rules: By incubation period is understood the time which, with regular, uninterrupted incubation of a newly laid egg, elapses until the young has left the egg; in nature it is generally possible to ascertain the incubation period with satisfactory exactitude by checking the time from the laying of the last egg to the hatching of the last young. To this I will add the qualification, when all eggs hatch.

These criteria are used by Nice (1937), Moreau and Moreau (1940), Skutch (1945), Sutter (1946), Löhrl (1951), and many others. As a rule this method gives the shortest normal incubation period, as the development of the embryo in the last egg continues without the interruptions to which the earlier eggs are subjected, as pointed out by Raspail (1903), Heinroth (1922:174), Kaufman (1938) and Peitzmeier (1953). On the other hand, Sutter quotes Noll (1924) as saying that in grebes and rails the last egg is sometimes neglected and thus takes longer to hatch than the others. It is well known that psychological factors can influence egg laying; in the presence of unfavorable circumstances the bird can retain the egg for some time in the lower part of the oviduct,

a fact that has become of special biological significance in parasitic cuckoos (Stresemann, 1927–34:259). A Cowbird (*Molothrus ater*), confined overnight, had laid two eggs by morning (Hoffman, 1929). In such a case in the wild, the first egg might conceivably hatch in 10 days instead of the 11 to 12 days observed in the 62 well authenticated instances I have been able to find for this species (Nice, 1953*a*). Patterson (1910) found that in hens an egg may be delayed 20 hours; Sutter mentions delays of 12 to 24 hours.

The incubation period can be shortened slightly, from 6 to 12 hours, in the incubator, according to Heinroth (1922:175). It can be considerably prolonged through the occasional postponement of the start of incubation (Ryves, 1946), through interruptions due to irregular attendance by the parent, and through inclement weather. Yet to include such aberrant figures merely confuses the picture. What we need to know is "normal" incubation and this may vary a day or more according to season, weather and attentiveness of the sitting bird.

A very interesting table is given by Richdale (1952:65) in which the "normal" incubation time of the Royal Albatross (*Diomedea epomorpha*) is shown to last from 77 to 81 days (5.2 per cent variation), in Black-footed (*D. nigripes*) and Laysan (*D. immutabilis*) albatrosses, from 63 to 67 days (6.4 and 8.1 per cent variation), but in the Yellow-eyed Penguin (*Megadyptes antipodes*) it apparently lasts from 40 to 50 days (25 per cent variation). The albatrosses, perhaps due to the presence of Skuas (*Catharacta lonnbergi*), "sit tightly on their eggs from the moment of laying," while the penquins whose eggs are usually placed under thick vegetation, away from danger from Skuas, "may not sit tightly for some days after the second egg is laid," that is, the start of steady incubation may be considerably delayed.

Several observers have reported on the effects of season and air temperatures on the length of incubation. In 24 nests of the Phoebe (*Sayornis phoebe*) in Iowa, incubation averaged 17 days in the first broods, but 15.5 days in the second (Sherman, 1952:99). European Wrens (*Troglodytes troglodytes*) in Holland averaged 17.5 days on their eggs in April, 16.3 in May, 15.2 in June, and 14.5 in July; early in the season the female has to spend more time finding food for herself than later (Kluijver *et al.*, 1940). Eggs in 10 nests of the House Wren (*Troglodytes aëdon*) hatched in 14 days with an average air temperature of 72°F. (22.2°C.), whereas 13 hatched in 15 days with an average temperature of 60°F. (20°C.) (Kendeigh, 1952:43-44). Four nests of the Chipping Sparrow (*Spizella passerina*) in warm weather averaged 11 days' incubation, whereas five nests in cool weather averaged 12.3 days (Walkinshaw, 1952).

HISTORY OF INCUBATION PERIODS IN THE OLD WORLD

The tendency, still found in many writers, to ascribe too short incubation periods to birds of prey and too long periods to some other species, is traceable to Aristotle. About 350 B.C. he wrote in Book IV, chapter 6, of his Historia Animalium: "The eagle broods for about thirty days. The hatching period is the same for the larger birds, such as the goose and the great bustard; for the middle-sized birds it extends over about twenty days, as in the case of the kite and the hawk" (Thompson, 1910).

Aristotle assumed that all large birds would approximate the domestic goose in length of incubation and middle-sized birds match the hen. In reality the Golden Eagle (*Aquila chrysaëtos*), as well as many other eagles, incubates for 45 days, and the Great Bustard (*Otis tarda*) for about 25. Kites incubate for about 30 days and hawks from 28 to 35 (see Nice, 1953*b* and in press).

Aristotle's guesses were quoted as definite facts by Pliny in the first century A.D., and, with the exception of Frederick II of Hohenstaufen, by all the major writers on

birds in the Middle Ages and Renaissance—Albertus Magnus (about 1260), Gesner (1555), Aldrovandi (1599) and Jonston (1657); they were also given by Buffon in the late eighteenth century. Thus the "Aristotelian age in incubation periods" lasted for more than 20 centuries.

In 1742 Zorn published 15 incubation periods of garden birds; some of these must have been based on observation. From 1791 to 1805 two other German ornithologists, J. M. Bechstein and J. A. Naumann, assigned incubation periods, based on the principle of size, for practically all the birds of middle Europe. Too short incubation periods were given to birds of prey, shorebirds, terns, gulls and others, and too long periods to some ducks, pigeons and passerines.

Tiedemann (1810–1814) copied Bechstein; this list was reprinted in the Ibis in 1891 by Evans, and part of it was used by Bergtold (1917) in America; at least one of Tiedemann's short periods (Least Tern, *Sterna albifrons*) was used in this country in 1949 (see table 2). J. F. Naumann in his Naturgeschichte der Vögel Deutschlands (1820–44) presented the same assumed periods as had his father; these volumes had an immense influence in Europe and Great Britain and set the pattern for reports of incubation periods for most of the books written in these countries in the nineteenth century. Their figures are still appearing in some popular works in Germany—Naumann (1905), Brehm (1922–26), Friderich (1923).

The first great investigator of this subject was the Scotch naturalist William Evans. In 1891 and 1892 he published incubation periods of 81 species determined by himself largely through the use of the incubator. He also included in a separate column figures given by others starting with Tiedemann. In his discussion he emphasized some of the worst errors that had prevailed in respect to the Charadriiformes and the Falconiformes, and he pointed out that the latter and owls "incubate for more or less protracted periods" (1891:91). Evans's work stimulated British ornithologists to rely on observation rather than faith. In the pages of the journals The Zoologist and its successor British Birds, there appeared many lists of incubation and fledging periods based on watching birds, while The British Bird Book (Kirkman, *et al.*, 1911–13) and The Practical Handbook of British Birds (Witherby *et al.*, 1920–24) plainly confessed ignorance in regard to many incubation periods. The admirable Handbook of British Birds (Witherby *et al.*, 1938–41) presented incubation periods that are nearly all trustworthy.

The second great investigator in this field was the distinguished German zoologist Oskar Heinroth. In 1908 he published incubation periods of some 80 species whose eggs he had hatched in the incubator. In 1922 appeared his great paper on "Relations between bird-weight, egg-weight, clutch-weight and length of incubation." In this, besides giving weights of 438 females and their eggs, he presented 100 incubation periods determined in the incubator, and he also formulated fundamental principles underlying incubation. Fifteen years later Groebbels (1937) brought out his second volume on Der Vogel in which he summarized nesting data for some 2000 species. For American birds he relied chiefly upon Bendire. In the meantime German ornithologists had been carefully studying their birds, especially hawks and owls; Niethammer's Handbuch der deutschen Vogelkunde (1937–42) presents incubation periods that with few exceptions are reliable.

In recent books on the birds of Sweden (Svärdson and Durango, 1950, and Durango, 1952) and on those of France, Switzerland and Belgium (Géroudet and Robert, 1940; Géroudet, 1942, 1946) the incubation periods are almost all trustworthy. For tropical Africa Moreau and Moreau (1940) published a list, based on their own experience, of incubation periods determined for some 45 species. In New Zealand Richdale has made fine contributions on breeding biology, including observations on a great many incu-

bation periods, of albatrosses, petrels and penguins. Although faulty incubation periods are still current in some popular books in Germany, so far as ornithologists are concerned, statements on this subject in Great Britain and northern Europe are on the whole satisfactory.

THE NEW WORLD

For a long time bird students in North America were too busy describing birds and their more conspicuous habits to spend time on careful life history studies. They possessed the same background as ornithologists in the Old World; indeed, Wilson, Audubon, Nuttall, Bendire and many others grew up across the Atlantic. It is no wonder they shared the firm conviction, handed down through the ages, of too short incubation periods for many birds.

Before Bendire

Alexander Wilson (1809–14) mentioned very few incubation periods: 12 to 14 days for "our small birds," 14 days for the Mockingbird (*Mimus polyglottos*), and a guess by his friend Dr. Potter, that the Cowbird (*Molothrus ater*) hatches in 9 to 10 days. Audubon (1831) gave free reign to his fancy in his tales of bird habits. He seems to have been the first author to assign 10 days as the incubation period of any bird, namely to the Ruby-throated Hummingbird (*Archilochus colubris*) (see Nice, 1953*a*). Evans (1891) quoted thirteen of his periods, five of which were reasonable, but most of the others were too short. All of these were copied by Bergtold and three have plagued us until the present, as shown in tables 1 and 2.

Very few incubation periods appear in the next forty years. Nuttall (1832) adopted Audubon's fabulous account of the Ruby-throated Hummingbird, but suggested that the Cowbird hatches on the 12th day. Turner (1886) followed Old World tradition as to length of incubation of gulls and terns, giving 21 days for the Glaucous Gull (*Larus hyperboreus*), despite Faber's (1825–26) record of 27 to 28 days, and 17 days for the Arctic Tern (*Sterna paradisaea*) and Aleutian Tern (*Sterna aleutica*).

The first American to provide a large number of birds with incubation periods was Gentry (1876, 1882). As he considered that incubation was a most wearisome task for both parent and chick, he compassionately made it short—8 to 10 days for various small birds, 15 to 16 for the Sparrow Hawk (*Falco sparverius*), 16 to 17 for the Sharp-shinned Hawk (*Accipiter striatus*), 18 for the Cooper Hawk (*Accipiter cooperi*), 20 to 21 for the Redtail (*Buteo jamaicensis*), 15 for the Screech Owl (*Otus asio*), 17 to 18 for the Barred Owl (*Strix varia*), 21 for the Great Horned Owl (*Bubo virginianus*), and 24 for the Barn Owl (*Tyto alba*). All in all, his figures seem as ridiculous to us as his flowery descriptions of behavior and his long lists of scientific names of the animal and vegetable food of each species which were much the same for each bird, merely arranged in varying order. But, although these learned-looking lists deceived some people for 50 years (see McAtee, 1912; Zimmer, 1926:239), the incubation periods fortunately were largely ignored except by some of his contemporaries. Even they considered his hawk figures too low, except for the longest, the 21 days for the Redtail. Warren (1888) called Gentry a "close observer and facile writer."

It is evident that at this time in America, as across the sea, people still agreed with Aristotle about the length of incubation in Falconiformes. In 1878 William Wood stated that Red-tailed and Red-shouldered (*Buteo lineatus*) hawks incubate about three weeks, the Broadwing (*Buteo platypterus*) "probably three weeks," and the Golden Eagle 30 days. In 1882, however, he wrote that he had made these statements "on the assertions of my collectors. Some oologists are very positive that hawks incubate 18 to 22 days." In the meantime he had become doubtful and he did a revolutionary thing: ten years before the publication of Evans's paper, he put hawks' eggs under sitting hens.

This appears to be the first instance reported of experimenting to find out the length of incubation of any wild species, except for the unsuccessful attempts of Zorn (1742). When two Red-shouldered Hawk eggs had not hatched after 27 days, Dr. Wood opened them and found two birds "evidently just ready to hatch." His Cooper Hawk eggs were chilled through the accidental shutting out of the hen after 26 days; they proved to be "well-developed." The Marsh Hawks (*Circus cyaneus*) "had cracked the shell on the thirtieth day but were unable to extricate themselves." This early scientist concluded: "I am satisfied that the period of incubation of our Hawks is from twenty-eight to thirty days."

Wood planned to continue his experiments and asked for help. "I have made arrangements this coming season to test the matter with an incubator. If those interested in this subject will send me fresh eggs of our Rapacia, I hope to be able to settle this question." Apparently no oologist could bear to give up an egg, for no further contributions on this subject appeared.

Carpenter in 1882 reported observations of about 27 days' incubation for Red-shouldered and Cooper hawks. In 1883 he found Long-eared and Barred owls hatching 26 days after discovery of the nests.

Warren, however, in his Birds of Pennsylvania (1888) overlooked these important papers and quoted Wood's earlier figures of about three weeks for Red-tailed and Red-shouldered hawks. He rejected Gentry's 18 days for the Cooper Hawk, believing the time required to be "three weeks or over"; he thought the Sparrow Hawk incubated 21 to 24 days.

Bendire

And now came the key figure who set the pattern for reports on incubation periods in North America. Major Charles Bendire had wide experience with birds throughout the western United States. His military career lent itself to his oological pursuits, but not to the time-consuming occupation of waiting for eggs to hatch. He wrote two large volumes on "The Life Histories of North American Birds," covering in the first (1892) the gallinaceous birds, doves, hawks, and owls, in the second (1895), the woodpeckers, hummingbirds, flycatchers, corvids and icterids. For the majority of species he simply stated an incubation period, usually qualifying it with "about." A large proportion of his figures, particularly for hawks and owls, are too short, whereas others, like most of those for woodpeckers, icterids and cuckoos, are too long.

Using size of bird as criterion and assuming that "the majority of Raptores" incubate "probably about four weeks" (1892:317), he alloted this figure to the Golden Eagle, the large buteos and the Osprey (*Pandion haliaëtus*), "somewhat over three weeks" to the Marsh Hawk, 21 to 25 days to the Broad-winged Hawk, about 24 to the Cooper Hawk, and "about three weeks" to the Sharp-shinned and Sparrow hawks. The incubation of the Great Horned Owl "according to the observations of several careful collectors is said to last only three weeks, but I believe that twenty-eight days comes nearer to the actual time required" (1892:382). He assigned 3 to 4 weeks to the Barred Owl, about 3 weeks to the Barn, Long-eared, and Burrowing (*Speotyto cunicularia*) owls and "about two weeks" to the Elf Owl (*Micrathene whitneyi*).

Bendire's figures, like those of practically all of his predecessors in the New and Old worlds, were largely based on guess. He rarely mentioned anyone else's authority, and when he did in two cases, the results were not happy. He quoted from the manuscript of L. M. Turner, whose too short periods for gulls and terns have already been noted: "I cannot speak positively, but I think that seventeen days are required to incubate the eggs" (1892:72) of the Willow Ptarmigan (*Lagopus lagopus*); and in regard to the Spruce Grouse (*Canachites canadensis*) he says, "the young are hatched in about sev-

enteen days" (1892:52). These figures have been quoted many times as positive data (see table 1), even though relatives of these grouse are known to take 24 to 26 days to hatch their eggs.

It is clear that most of Bendire's fellow oologists firmly believed in three-week incubation periods for the larger hawks and owls. Bendire himself had written in 1882 in regard to the Long-eared Owl: "The eggs are hatched in about sixteen days," and this was quoted by Ridgway (1889). Although in 1892 Bendire does not cite Wood's (1882) and Carpenter's (1882, 1883*a*, 1883*b*) papers, he may well have been influenced by them to revise his opinions on length of incubation in raptorial birds. He seems to have been so convinced, however, that the incubation period must be correlated with size of bird that he could not give the Cooper and Marsh hawks and the Long-eared Owl credit for the length of incubation ascertained by experiment and observation.

There is no evidence that he, or anyone else in the United States concerned with this subject, was aware of Evans's papers (1891, 1892). They were not reviewed in The Auk, as The Auk and The Ibis did not exchange until 1908. While Evans started his countrymen on the search for truth, Bendire, like Naumann, gave the impression that things were well known and thus closed the door to inquiry.

Bendire's periods were better than those prevalent at the time both in his native Germany and his adopted country, yet this proved little advantage in the long run. If they had been glaringly bad, they might have been less widely adopted. As it was, despite the qualifying "abouts," his estimates were largely accepted as proven facts and as such have been copied to the present day. Unfortunately, the great majority of Bendire's incubation periods are faulty.

After the publication of Bendire's volumes, incubation periods appeared in a vast array of bird books in the New World. His figures were used by Fisher (1893), Knight (1908), Eaton (1910–1914), Burns (1915), Bergtold (1917), Bent (1921–1940), Forbush (1925–1929), Roberts (1932), and many others. They were also copied in the Old World (Needham, 1931; Groebbels, 1937). But since he did not live to complete the books he planned on the rest of the families, people had to make up many incubation periods of their own. Both Dugmore (1900) and Wheelock (1904) had a predilection for short incubation periods, each crediting some vireos with 7 days. Although Mrs. Wheelock wrote: "in Bird Lore it is never safe to hazard a guess," her incubation periods seem to have been allotted hit or miss, as a sample from the Falconiformes will show: Golden Eagle, 3½ weeks, Swainson Hawk (*Buteo swainsoni*), 21 to 22 days, Marsh Hawk, 18 to 20, Osprey, "little more than two weeks," yet Cooper Hawk, 31 days. Dugmore was quoted by Bergtold, but Wheelock seems to have been almost wholly ignored, the only citation of her work I have found being for 27 days for the Golden Eagle (Forbush, 1925–1929).

In the 21 years following Bendire's first volume, reliable figures were given for three North American birds of prey. [Bergtold's reference to Kobbé's (1900) record on the Sparrow Hawk is an error. This is an article on the Rufous Hummingbird (*Selasphorus rufus*), that incubates "a few weeks"! Kobbé seems never to have written on the Sparrow Hawk.] Hegner (1906) published observations on a nest of the Red-tailed Hawk: on April 5 it was empty, on the 11th it contained 2 eggs; on May 13 in the morning "the first Hawklet broke through the shell"; on May 15 the other egg hatched. This gives at least 34 days for the second egg. Bergtold mentioned this record (as 32 days), but everyone else seems to have overlooked it. The only other observations I have found on incubation period of this species were made in Utah by Hardy (1939); he found it to last 34 to 35 days. Althea Sherman constructed nesting boxes with peep holes in them, and by careful and prolonged watching ascertained the exact time of the laying and

hatching of the eggs of a number of species. She found that the incubation period of the Flicker (*Colaptes auratus*) was 11 to 12 days (1910), that of the Screech Owl 26 days (1911), and that of the Sparrow Hawk 29 days (1913). Her pioneer studies, both their technique and their results, did not make the impression they deserved. People continued to quote haphazardly. Forbush said of the Flicker: "period variously given as 11 to 16 days"; of the Screech Owl: "period 21 to 25 days (authors)"; and of the Sparrow Hawk: "period given by some authors as about 21 days, and by others as 29 to 30 days, latter probably nearly correct."

Knight, Burns, and Bergtold

In this century the three men most often quoted on incubation periods in North America are Knight, Burns, and Bergtold. The first two observed to a small extent, but mostly guessed and copied; the third copied.

Ora W. Knight, botanist and ornithologist, specializing in oölogy, published his Birds of Maine in 1908. In the preface he explained that he calculated the start of incubation "from the day when I had reason to believe the female had actually commenced to incubate . . . to the time when the first egg was hatched . . . . It is therefore to be understood that my observations regarding the incubation period are to be taken subject to such variation as may be produced by errors of judgment due to not correctly understanding the true conditions in a given case." This method involves an unknown at the start. Knight's followers, however, seem to have overlooked the preface and trustfully copied the positive statements in the text. While he said nothing about incubation in owls, he credited the Red-shouldered Hawk with 27 days, quoted Bendire for the Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) as 14 days, and evidently followed him in the case of other birds, particularly in the too long periods for the Icteridae. He gave many reasonable incubation periods, but also many bad ones: Spotted Sandpiper (*Actitis macularia*), 15 days (see table 1); House Wren and Black-capped Chickadee (*Parus atricapillus*), 11 to 13, instead of 13 to 15; Phoebe, 12 instead of 15 to 17 (Sherman, 1952:99); and Song Sparrow (*Melospiza melodia*), 10 to 14, instead of 12 to 13 (Nice, 1937).

It was Frank L. Burns's list that did much more harm. He was a zealous amateur and originally an egg collector. He was the author of long monographs on the Flicker (1900) and the Broad-winged Hawk (1911), both compilations, and of a pioneer nesting study of a square mile (1901) in which he actually located the nests. In 1915 appeared his "Comparative Periods of Deposition and Incubation of Some North American Birds," in which he gave incubation periods for 225 species and subspecies, in no single instance mentioning his authority. "My conclusions are based upon the statements of authors, the manuscript notes [of 10 correspondants], and my own observations" (p. 276). The list was "compiled from various sources and in many instances from single records, some of which may be inaccurate and are questioned; others may be subject to revision; but none are included without good authority" (p. 281).

The majority of the periods evidently stem from Bendire, although some of these were slightly modified; for instance, where Bendire's figures ranged over 3 to 7 days, Burns chose one or the other. The next largest source appears to have been Knight, although occasionally a good figure from this author was replaced by a bad one of unknown origin. Others were taken from journals and books. Fully half of his records are erroneous, some of them strikingly so, especially in regard to rails, shorebirds, hawks, owls, hummingbirds, icterids, and many other passerines. Heinroth (1922:177) found in this list so many errors, even with the best known birds (Domestic Dove, 14 instead of 17 days; *Fulica,* 14 instead of 22-23; *Lagopus,* 18 instead of 26 days), that he had to "refrain from using it."

The list was welcomed. Stone (1915) in a half page review wrote: "Mr. Burns has done a good work in compiling a list setting forth the time of incubation for some 225 species and races of North American birds. The only weak point in Mr. Burns's paper is that he does not quote his authority for the individual figures, and the list of authors and correspondents from whose statements the list is compiled, must necessarily represent a considerable range of accuracy." He then criticized him for appending a question mark to 29-30 days for the Sparrow Hawk, in view of Miss Sherman's "most careful study of this species. At all events Mr. Burns's list is an excellent foundation on which to build."

It was certainly built upon! The article has a great deal to answer for, as it offered in convenient form in an easily accessible journal the guesses of Bendire and Knight, as well as a scattering of much wilder guesses, all set down as facts, except for the 14 question marks which seemed to have been placed more or less at random. At any rate, this mark after 14 days for the Sora (*Porzana carolina*) did not discourage five authors from copying this figure, although they did prefix "about" or "said to be."

One of the worst features of Burns's list was its lack of references, for no one could check the evidence on which each figure was based. Yet for 36 years this list has been copied, no matter how fantastic the data.

The next list gave the sources. W. H. Bergtold, Denver physician, published in 1917 a book of 108 pages entitled "A Study of Incubation Periods in Birds. What Determines their Length?" Some 800 incubation periods are presented for 625 species of birds of the world. This was by far the largest list until Groebbel's book (1937). The source is given for each period by a figure which refers to the bibliography of 197 abbreviated titles for which dates are largely lacking. Dr. Bergtold said: "Inasmuch as a great deal of the literature used in this study was wholly inaccessible to the writer and had to be copied for him, he fears that some errors incidental to such transcribing may well have crept in, for which he expresses his regret, however unavoidable on his part these errors may have been" (p. 10). He does not, however, indicate which sources he consulted personally. He also stated: "The author is confident that some of the incubation-length records included in this list are grossly incorrect, yet they are incorporated in the data, with a feeling that they will, in the future, be more accurately determined, and in that form recorded, and thus be corrected" (p. 77).

The table of incubation periods includes 225 periods from Burns, 59 from Bendire's first volume (strangely enough the second was missed), 183 from Evans's two papers, 47 from Heinroth (1908), and smaller numbers from various authors in North America, Europe, New Zealand and Australia.

It is unfortunate that the copier did not use better judgment in the figures taken from Evans, for along with some of the reliable ones determined by this ornithologist and others, there are many that are glaringly incorrect. Twenty-two records stem from Tiedemann, and 13 from Audubon with others from Naumann and his followers. At times an ancient guess was preferred to authentic observation, as 21 to 24 days for the Eagle Owl (*Bubo bubo*) instead of 36 found in an aviary, 16 to 17 days for the Stone Curlew (*Burhinus oedicnemus*) instead of a month, 23 days for the White Stork (*Ciconia ciconia*) instead of five other statements of a month, and so on. Eleven records were attributed to Dugmore of which seven are bad, but the worst of all—17 days for the Canada Goose (*Branta canadensis*)—does not occur in any of the editions of Dugmore's book.

Unlike Evans's list, where the results of experiments and observations were clearly divided from the statements of earlier writers, all of Bergtold's periods are listed con-

secutively with no indication as to the reliability of the source except the key number. And because of the indiscriminate jumbling of Evans's original and historic figures, it is impossible to place reliance upon a figure merely because it is attributed to him.

Stone (1917) devoted two pages to a review of this "valuable contribution to a neglected line of research," his only criticisms being in regard to "evidences of hasty proof reading" and an erroneous citation of the finches of Australia which "are really Weavers." Bergtold's contribution would have been far more valuable had he omitted the many periods he believed "grossly incorrect," or if he had at least indicated which these were. As it was, he merely perpetuated them; they have been quoted by many authors and have been used to bolster inadequate theories (Needham, 1931; Worth, 1940, see Nice, 1940; Huggins and Huggins, 1941, see Nice, 1941). Needham wrote: "What governs the incubation times of birds? . . . by far the best treatment of it in the literature at present is the book of Bergtold." Whereupon he quotes 131 figures, many of them very mistaken. Needham is quoted by Worth and the Hugginses, and undoubtedly will be quoted for many years to come, for biochemists are not as a rule in a position to check upon ornithological facts.

Bergtold's list has been widely used and is still being used for want of something better in this country. Heinroth's great paper remained almost unknown here for many years. In The Auk (1923:366), where many articles were reviewed at length, Heinroth's was listed with the comment: "A lengthy discussion with tables and charts of variation curves." If its true worth had been realized and an adequate review given, Bergtold should not have written in 1929 that "There are available in the literature, so far as the writer has been able to learn, data relating to the [egg] weights of only about sixty bird species." Nor should various superficial theories on length of incubation have later been propounded in this country.

In the last 35 years there have been many studies of individual species in which incubation periods have been carefully determined. The most notable paper by an American dealing with a large number of species is that of Skutch (1945) on "Incubation and Nestling Periods of Central American Birds." In this he summarizes his own careful observations on incubation periods in 90 species and nestling periods in 120. He found that incubation in species of wood warblers, some of the wrens, and some of the tyrant flycatchers was longer than in species of these families at higher latitudes.

An important contribution to the subject of nesting behavior is Kendeigh's book on "Parental Care and Its Evolution" (1952). After describing in detail observations largely made by mechanical records on incubation and care of nestlings in the House Wren and 19 other North American species, he discusses parental care throughout the class Aves with examples that are in the main reliable. Tables 42 to 50 give incubation periods from particular studies for 133 species from the Cuculiformes through Passeriformes. It is a pity that the Bendire tradition was so strong that in the summary on the Falconiformes (p. 193) the incubation period is said to be "commonly about 4 weeks long," a statement belied by the dozen periods of individual species given in the pages immediately preceding, as well as by the figures on page 283. In table 51, in the preparation of which I was privileged to assist, a summary is presented of "attentive behavior by families," in which the range in length of incubation periods is reported according to the best information available. Statements in the text should be checked against this table which contains the latest findings. The book should serve as a guide and stimulus to further research.

A SUMMARY OF SOME OF THE PERSISTENT ERRORS IN NORTH AMERICA

The source and course of some of our popular errors in incubation periods in this

country stemming from Tiedemann, Audubon and Bendire to the present are shown in tables 1 and 2.

Table 1

Some Persistent Errors Concerning Incubation Periods of New World Species

Herons to Shorebirds

Species	Audubon 1831	Bendire 1892	Knight 1908	Burns 1915	Bergtold 1917	Different compilations 1920's	1930's	1940's	Correct period
Green Heron, *Butorides virescens*				17	17	17	17	17, 20	20±
California Condor, *Gymnogyps californianus*	29–31				29–31		29–31	29–31	?
Black Vulture, *Coragyps atratus*	32	30±		30	30, 32, 40	30±	28, 39	28	39–41
Sharp-shinned Hawk, *Accipiter striatus*		21±		21	21	21–24	21–24	21–24	34–35
Golden Eagle, *Aquila chrysaëtos*		28±		35	25–35	27, 30	28–35	30	43
Sparrow Hawk, *Falco sparverius*		21±		29–30?	21, 29–30	21, 29–30	29, 30	28, 29	29
Spruce Grouse, *Canachites canadensis*		17?			17		17	17, 24±	24±
Clapper Rail, *Rallus longirostris*	14				14	14		14	21–23±
Sora, *Porzana carolina*				14	14	14	14	14, 16–19	19
American Coot, *Fulica americana*				14	14	21–22, 27	21±	27	23–24
Spotted Sandpiper, *Actitis macularia*			15	15–16	15–16	15–16	15–16	15, 21	21

The references for the 1920's are Bent (1921, 1926, 1927–1929) and Forbush (1925–1929); for the 1930's, Bent (1932, 1937–1938, 1939), Roberts (1932), and Oberholser (1938); for the 1940's, Bent (1940), Hann (1945), E. L. Palmer (1949), R. S. Palmer (1949), and Sprunt and Chamberlain (1949).

In table 1 Burns's 17 days for the Green Heron was quoted up to 1949 (Sprunt and Chamberlain), but that same year R. S. Palmer cited Cooley's (1942) observation of about 20 days. This is consistent with the incubation periods of other herons.

Audubon's statement of 29 to 31 days for the California Condor was based on fantastic stories told to David Douglas, the young Scotch plant collector. This is copied by Needham (1931) from Bergtold via Evans. As yet there is no satisfactory observation on the incubation period of this bird. In his excellent study of this difficult species Koford (1953:85) found it was "at least 42 days." Already in one review this has been changed to "about 42 days" (Tanner, 1953). The South American Condor (*Sarcorhamphus gryphus*) has long been known to take 54 to 56 days in captivity (Evans, 1892; Heinroth, 1922; letter from Mrs. Belle Benchley, former director of the San Diego Zoo). Its eggs average 275 grams in weight, those of the California Condor 298 grams.

The incubation period of the Black Vulture was reported as 40 days by Heinroth (1908) on the authority of Ludwig Wunderlich, director of the Cologne Zoo from about 1888 to 1928. Thomas (1927) found it lasted 39 to 41 days.

I have found no published observations on the incubation of the Sharp-shinned Hawk, but Dr. Alden H. Miller and Dr. Wade Fox, Jr., inform me of a nest in Berkeley, California, in 1944 in which incubation lasted 34 to 35 days. This is consistent with the findings on European accipiters.

The most popular figure for the Golden Eagle in North America was Bendire's of 4 weeks,

although Burns's 35 days was sometimes quoted. Apparently this came from Henninger and Jones (1909) who gave some of their "Falcones" incubation periods for which no sources were indicated. Thirty days was quoted as late as 1949 (E. L. Palmer). The only record based on observation that I have found for the American form is that of Walker and Walker (1939) for 43 days.

Althea Sherman (1913) found that the last egg of a set of Sparrow Hawk eggs hatched 29 days after it was laid.

The origin of the 17 days for the Canada Spruce Grouse has already been mentioned. E. L. Palmer repeats this both in 1949 and 1953. R. S. Palmer (1949:162) says: "Incubation probably requires about 24 days." Apparently there are no observations, but this latter figure matches that of related forms.

Audubon's guess of 14 days for the Clapper Rail was copied for 118 years; I have just prevented its reappearance in 1953. In 1949 Kozicky and Schmidt published on this species and gave an average incubation period of 20 days for six nests. But as they considered this period "as starting when the last egg was laid and ending when the first chick hatched," and as hatching spread over 24 to 48 hours, it is obvious that their figure is one or two days too short. I wrote to the authors asking whether they could give me the period from the laying of the last egg to its hatching, but they were unable to do this. They said that observations on five nests in 1950, calculated in the same way as for the first six, ranged from 19 to 23 days, averaging 21.5. From 21 to 23 days would seem approximately correct, until we can get observations made in proper fashion.

Ward D. Tanner has made a special study of the Sora in Iowa; he writes me he found the incubation period in five nests was 19 days and in one 20 days.

Burns's astonishing figure of 14 days for the Coot was quoted by Bergtold, but apparently by no other American. It is, however, continued in Needham's list. Forbush volunteered 27 days and this was used by E. L. Palmer (1949). Gordon W. Gullion, who has made an intensive study of this species (in press), finds that incubation lasts 23 to 24 days.

Knight's guess of 15 days for the Spotted Sandpiper had a great vogue, being quoted as late as 1949 by E. L. Palmer. This in spite of Smith's (1914) finding it was *more* than 17 days, and Nelson's detailed study (1930) that established the incubation period as 21 days, later corroborated by Mousley (1937). Miller and Miller (1948) recorded 20 to 22 days in three nests; I noted 21½ in one nest.

Tiedemann's statement of 14 to 16 days for the Least Tern was quoted by Evans and copied by Bergtold, and since then by Bent, Forbush, Needham, and Sprunt and Chamberlain (1949); this is the longest-lived error in the tables—135 years. I can find no observations on our American subspecies, *Sterna albifrons antillarum,* but Heinroth in 1922 found a period of 21.5 days for *S. a. albifrons.*

In regard to the Black Tern, in 1904 Seton and Chapman reported they had found an egg on June 16 and another on June 18; one had hatched by July 5 "after an incubation period, therefore of seventeen days." Since they knew neither the laying nor hatching date of either egg, this guess of 17 days was unfortunate. It was adopted by Burns and copied until 1949, although Bergtold interpreted the observations as "17 to 19? days." For the European subspecies Haverschmidt (1945) determined that the eggs in three nests hatched in 20 to 22 days. Robert E. Goodwin, who has studied this species in New York state, tells me that marked eggs hatched in 21 to 22 days.

The three owls in table 2 were assigned "about three weeks" by Bendire. Burns interpreted this for the Barn Owl as 21-24 days and thus it has been copied in each decade up to 1949. I can find no American observations, but Witherby *et al.* (1938) give 32 to 34 days and Niethammer (1938), 30 to 34. In 1911 Sherman published her intensive study of the nesting of the Screech Owl in which she found the incubation period of the last egg was 26 days. Burns, however, would not give up Bendire, so stated it to be 21-26 days. The "21" has stuck until 1949, although 30 is also included; this was first proposed by Bent (1938) who said "21-30, probably about 26." The Long-eared Owl was put in the 21 to 24 day class by Tiedemann. Americans followed Bendire's 21 days except that Forbush said 21-30 days with no hint as to the authority for the latter figure, and this was copied by Roberts (1932) and E. L. Palmer (1949). Sumner (1929) found the period to last about 28 days. Evans (1891) and Heinroth (1922) observed that the incubation period of *Asio otus otus* was 27 days.

Audubon assigned a 10-day incubation period to the Ruby-throated Hummingbird and a 7-day fledging period, instead of the 21 to 25 days the young really spend in the nest. The 10-day incubation period appeared in Evans and from there in Bergtold. Hummingbirds have long incubation periods; it is 16 days for this species (Skutch, 1945; Kendeigh, 1952:285).

As to the Belted Kingfisher, Audubon and Bendire guessed 16 days and Finley (1907) 16-17, and this persisted to 1949 (E. L. Palmer). For once Burns was right with 23-24 days; this was what Mousley found in 1938.

The history of the incubation period of the Flicker gives us a perfect example of ascertaining its length, but a sad example of the indifference of others to scientific standards. Miss Sherman (1910) watched the eggs being laid, marked them, and watched them hatch; the last egg in one set took 11 days and 8 hours, in another 11 days and 5 hours. "Roughly speaking, then, the time that our Flickers take for incubation is from eleven to twelve days." In 1900, Burns had published an 82-page treatise on the Flicker but could offer only "one record of the duration of incubation"—14 days, provided by Lynds Jones. In 1915 he gave 11-14 days for this species. Bergtold gave 11-12 days from Sherman's Flicker paper, 11-14 from Burns, and "about 16 days" from Sherman's Sparrow Hawk paper (1913:412). She had said: "The Flickers . . . hatched out their brood on June 6—the first egg having been laid on May 21." Bergtold was thus counting from the laying of the first egg to the hatching of the last, and as the Flickers laid from 7 to 9 eggs in a clutch, this constituted a "grossly erroneous" value. Nevertheless, 16 days was repeated each decade; the only authors of the compilations cited who respected Miss Sherman's work and gave 11 to 12 days as the period were Bent (1939) and R. S. Palmer (1949).

Bendire's 15-17 days for the Eastern Meadowlark have been copied by every one of our compilers up to the present. Dr. George Saunders, who studied this species intensively, writes that he found that incubation lasted 13 to 14 days.

The myth of the 10-day incubation period of the Cowbird has been treated in detail elsewhere (Nice, 1953*a*). R. S. Palmer was the only compiler to notice the many refutations from 1918 (Shaver) on, the most important of which are Nice (1937), Hann (1937), and Norris (1947).

Table 2

Some Persistent Errors Concerning Incubation Periods of New World Species

Terns to Icterids

Species	Tiedemann 1814	Audubon 1831	Bendire 1892–95	Knight 1908	Burns 1915	Bergtold 1917	Different compilations 1920's	1930's	1940's	Correct period
Least Tern, *Sterna albifrons*	14–16					14–16	14–16		14–16	20–22
Black Tern, *Chlidonias niger*					17	17–19?	17	17	17	21–22
Barn Owl, *Tyto alba*			21±		21–24	21–24	21–24	21–25	21–24	32–34
Screech Owl, *Otus asio*			21±		21–26	21, 25	21–25	21–30	26, 21–30	26
Long-eared Owl, *Asio otus*	21–24		21±		21	21	21–30	21–30	21–30	28±
Ruby-throated Hummingbird, *Archilochus colubris*		10	14±	12	14	10, 14, 15	14	14, 16	11, 12 14, 16	16
Belted Kingfisher, *Megaceryle alcyon*		16	16±		23–24	16, 23–24	16–17, 23–24	16–17	16–17, 23–24	23–24
Yellow-shafted Flicker, *Colaptes auratus*			15±		11–14	11–14, 16±	11–16	11–12 11–16	11–13, 14–16	11–12
Eastern Meadowlark *Sturnella magna*			15–16	15–17	15–17	15–17	15–17	15–17	15–17	13–14
Cowbird, *Molothrus ater*		14±	10–11	10	10	10, 10–11, 14±	10–12	10	10, 11–13	11–12

DISCUSSION

Let us examine the factors that have been believed to influence duration of incubation, then consider some related problems that have been neglected, and finally ask ourselves why ornithologists have so trustingly repeated ancient errors for 2300 years. The strong conviction of most ornithologists throughout some 23 centuries has been that length of incubation depends primarily on the size of bird or egg. Various supplementary factors have been suggested. Climate and season were mentioned by Aristotle, Tiedemann and Newton. Gurney (1899) believed that "The period of a bird's incubation seems to have something to do with the length of its life." He thought parrots were an exception, but in reality they support his theory. Some long-lived birds have long incubation periods. This is true of albatrosses, Falconiformes, Strigiformes, and Psittaciformes. Richdale (1952:124) found that the Royal Albatross does not breed until its ninth year. However, geese, swans, gulls, and terns are long-lived, yet their incubation periods are comparatively short. The state of perfection in which the young bird leaves the egg was considered important by Tiedemann, Zorn, and Newton (1893–1896), but not by Burns and Bergtold.

The influence of the temperature of the parent was mentioned by Frederick II (1943). This was also Bergtold's main contention, in favor of which he demolished to his own satisfaction 16 alternative theories, including size of bird and egg, and site of nest—protected or unprotected.

Bergtold cited Heinroth's (1908:22) report that eggs of the Egyptian Goose (*Alpochen aegyptianus*) hatched in 28 days under a hen and in 30 days under a Muscovy Duck (*Cairina moschata*) as experimental evidence of his theory, and this is quoted in turn by Needham and by Huggins and Huggins. Heinroth made no comment on this two-day difference; perhaps the Muscovy had been a poor sitter. In 1922 he gave 28 days as the period for the Egyptian Goose. In this paper (p. 176) he rejected the idea of shorter periods depending on differences in temperature of the sitting bird; if the like-sized eggs of pigeons and Barn Owls (*Tyto alba*) are exchanged, those of the first species take 17 days, those of the second 30, just as under the real parents. Zorn had already (1742–1743) established this in turkeys, hens and pheasants. Did Bergtold, Needham and the Hugginses check the temperatures of Muscovy Ducks and domestic fowl before jumping to their conclusions? Apparently not. In Bergtold's table 6 the temperatures of hens and ducks appear to be about the same, averaging about 107°F. Wetmore (1921) also found the temperature of ducks high, averaging 107°F.; his one example of *Cairina* was 107.7°, his averages for hens 106.4°–106.9°F.

Bergtold does not attempt to match long and short incubation periods with low and high temperatures of the parents. His 9 ostriches with their very short incubations average 100°F.; his 21 adult procellariiforms with their exceedingly slow incubations average 105°. Most of his other birds show somewhat higher temperatures. Gross (1935:391) states that the temperature of adult Leach Petrels (*Oceanodroma leucorhoa*) was 106°F. Wetmore found the temperature of grebes, pelicans, herons and a Turkey Vulture (*Cathartes aura*) ranged between 103.6° and 104.3°F.; that of hawks averaged 106°; gulls and shorebirds 106.7°; ducks 107°; quails 107.6°; passerines 107–108°; woodpeckers 108°; pigeons 108.2°; and cuckoos 108.7°.

Baldwin and Kendeigh (1932:149) point out the incorrectness of Bergtold's assumption that "the optimum incubation temperature for any species is the temperature of the incubating parent." They found the temperature of female birds of eight passerine species in the breeding season averaged 106.3°F. (41.3°C.). By inserting thermocouples in House Wren eggs kept in the center of the nest they recorded an average of 93.1°F. (34°C.) in 26 inattentive periods, and 98.5°F. (37°C.) in 26 attentive periods. Huggins (1941) investigated egg temperatures of 37 species of 11 orders from Ciconiiformes to Passeriformes by inserting thermocouples into the eggs, but allowing the eggs to be moved about by the parents. "The average egg temperature for all orders is 34.0°C., the average for the attentive period 34.3°C., and that for the inattentive period 33.4°C."

Size of bird and/or egg was the yard-stick for Aristotle and his followers, and for Bechstein and Naumann and their followers down to Géroudet, in the Old World, and from Bendire and Burns to Worth and the Hugginses in the New World. Size of egg is related to size of birds; eggs become relatively smaller in larger birds, but each group shows a characteristic size relation of its own (Heinroth, 1922; Huxley, 1927; Amadon, 1945).

Although Bergtold emphasized the inconsistencies in considering egg size the crucial factor in determining length of incubation, ironically enough several people have concluded the opposite, basing their evidence on his list. Needham (1931:478) states, "The length of the incubation period varies more or less with the size of the bird," and he presents a table and chart on double log paper to prove it. Unfortunately, as mentioned earlier, a large proportion of his incubation periods are far from correct. Worth and the Hugginses accepted Needham's conclusions. Worth was unacquainted with Heinroth's papers, and, although Needham and the Hugginses cite them, they show no evidence of having been influenced by them.

Worth (1940) calculated the volume of eggs from their measurements by an elaborate formula rather than using the simple method of Schönwetter (1924, 1932; see Nice, 1937:113) for obtaining weight. Worth chose 104 incubation periods from Bergtold, using single figures or averages, whichever agreed best with his theory. Half of these periods are erroneous. He plotted the egg volumes against these periods and found only 4 or 5 days' deviation on either side of the line representing the "average or expected incubation period." Hence he concludes that with a second formula he can calculate the average incubation period of any egg from its measurements, allowing "an ecological correction not exceeding five days in either direction." Even though one term of his basic material was so faulty, he rightly concluded that birds with short incubation periods are "subject to predation or some other type of environmental onslaught," and that predacious birds develop slowly. But he greatly underestimated the amount of retardation or acceleration, as will be seen in tables 3 and 4.

On the basis of their experiments on egg temperatures, Huggins and Huggins (1941) reject Bergtold's theory. They also consider it "unnecessary to postulate an ecological factor to account for variations in length of incubation compared with egg volume, as Worth does," and conclude: "The evidence presented would seem to indicate that there is a general positive correlation between egg weight or volume and length of incubation." Like Needham and Worth, the Hugginses apply these generalizations to all birds regardless of order or family.

What have the two chief investigators of this subject to say on the factors influencing length of incubation?

Evans (1891:91) concluded that only in "birds possessing a certain amount of affinity" is size of egg correlated with length of incubation.

It is Heinroth who gave the most illuminating analysis of the subject with his extensive table, elaborate charts and discussions (1922:178, 279-285). After pointing out what false conclusions have resulted from Naumann's assumption of the dependence of length of incubation on size of egg, he admitted that *within a group* there *may* be such a relation, but that there are many exceptions. The state of development of the young often has an influence, but again with many exceptions. He believed that very long incubation periods are somewhat primitive and have persisted where the brood is little endangered, as in most birds nesting in holes and on islands, or in birds of prey. Short incubation periods are correlated with danger to the eggs from flooding or predation, and with repeated nesting during a season. Long incubation periods are characteristic of Casuariiformes, Apterygiformes, Sphenisciformes, Procellariiformes, Falconiformes,

Table 3

Some Eggs of Like Size and Their Incubation Periods

Species	State at hatching	Weight of eggs in grams	Incubation period in days	Authority
Cassowary, *Casuarius* sp.	precocial	550	56	Heinroth (1922)
Rhea, *Rhea americana*	precocial	575	35–40	Heinroth (1922)
Royal Albatross, *Diomedia epomophora*	altricial	416	77½–81	Richdale (1952)
Kiwi, *Apteryx mantelli*	precocial	415	75	Harmon (1950), Robson (1948)
South American Condor, *Sarcorhamphus gryphus*	altricial	275	55	Heinroth (1922)
Black Swan, *Cygnus atratus*	precocial	290	35	Heinroth (1922)
White Pelican, *Pelecanus onocratalus*	altricial	165	36	Heinroth (1922)
Canada Goose, *Branta canadensis*	precocial	170	28–29	Witherby (1939)
Little Owl, *Athene noctua*	altricial	16	28–29	Witherby *et al.* (1938–1941)
Stock Dove, *Columba oenas*	altricial	16	16–18	Witherby (*op. cit.*)
Storm Petrel, *Hydrobates pelagicus*	altricial	7	38–40	Lockley (1932)
European Quail, *Coturnix coturnix*	precocial	7	18	Heinroth (1922)
Song Thrush, *Turdus ericetorum*	altricial	7	13½	Lack (1948)

Psittaciformes, Strigiformes, and Trochilidae. Short incubation periods are found in Struthioniformes, Rheiformes, some Anatinae, Turnicidae, Columbidae, Picidae, and most Passeriformes.

Let us examine the incubation periods of 13 species of birds with eggs of like size. In each of the six sets of birds in table 3 representatives of different orders are compared. In five sets the periods are markedly different, ranging from one-third and two-thirds longer in eggs weighing from 16 to 575 grams, and as much as three times as long in two species laying eggs of 7 grams.

As to the state of perfection in which the young are hatched, in only one case does a precocial chick take longer for its development than an altricial chick of like size—the European Quail in contrast to the Song Thrush. In four cases, on the contrary, the precocial chicks have *shorter* incubation periods than the altricials of similar size. The period of the Kiwi deserves notice; this was mistakenly reported as 42 days by Bergtold, Needham and Worth; the source was Evans, his authority being Gould who reported it as such "according to a native" (Brehm, 1875). It is clear that incubation periods of birds of different orders do not correspond to size of egg.

Even more striking are the results when we compare certain eggs of like incubation periods. In table 4 some of the birds are from different orders, but in one set all three are of the same genus. In the three swans the egg of the largest weights 1.7 times as

much as that of the smallest, yet all hatch in 35 days. In the sets composed of different orders we find eggs hatching in the same length of time as others 6, 32, and 40 times their size. Here again is striking refutation of the belief that length of incubation depends on size of egg, even in some cases within one family and within one genus.

Table 4

Some Eggs of Like Incubation Periods and Their Weights

Species	State at hatching	Weight of eggs in grams	Comparative size	Incubation period in days	Authority
Emu, *Dromeus novea-hollandiae*	precocial	600	40	56	Heinroth (1922)
Fairy Prion, *Pachyptila turtur*	altricial	24	25	56	Richdale (1944)
Diving Petrel, *Pelecanoides urinatix*	altricial	15	1	56	Richdale (1945)
Ostrich, *Struthio camelus*	precocial	1500	25	42	Heinroth (1922)
Gannet, *Sula bassana*	altricial	102	15	43–45	Witherby (1940)
Puffin, *Fratercula arctica*	altricial	60	1	42	Lockley (1934)
Mute Swan, *Cygnus olor*	precocial	350	1.7	35	Witherby (1939)
Black Swan, *Cygnus atrata*	precocial	290	1.4	35	Heinroth (1922)
Black-necked Swan, *Cygnus melanocoryphus*	precocial	210	1	35	Heinroth (1922)
Stock Dove, *Columba oenas*	altricial	16	32	16–18	Witherby (1940)
Broad-tailed Hummingbird, *Selasphorus platycercus*	altricial	0.5	1	16	Bergtold (1917)
Flicker, *Colaptes auratus*	altricial	7.8	6	11–12	Sherman (1910)
Cowbird, *Molothrus ater*	altricial	3.2	2.5	11–12	Nice (1937)
Lesser White-throat, *Sylvia curruca*	altricial	1.3	1	11–12	Lack (1948)

The greatest contrast in table 4 lies between the eggs of the Diving Petrel and the Ostrich. *The 15-gram egg of the former takes two weeks longer to hatch out an altricial chick than does the hundred-times larger egg of the latter to turn out a precocial bird.*

The very short incubation period of the Ostrich (Mosenthal and Harting, 1877; Watson, 1905), in Africa with its wealth of predators is in marked contrast to the long periods of the Emu and Cassowary in predator-free Australia, as pointed out by Heinroth (1938:43). The development of the egg of the Rhea appears also to have been accelerated in response to enemies.

Two of the birds in these tables with long incubation periods are predators—the Condor and Little Owl. The Condor can have few natural enemies, while the owl is both a predator and a hole-nester. Most of the other birds with prolonged incubation nest in protected places: pelicans and Gannets on islands, the small petrels and the Puffin in holes in the ground on islands, the Kiwi in a hole. Lack (1948:30) has shown that the Nightingale (*Luscinia megarhyncha*) in its open nest incubates 13 days in contrast to 13½ to 14½ days in three hole-nesting Turdidae with eggs of similar or smaller size. In Central America, Skutch (1945:31) gives incubation periods for 18 species of Tyran-

nidae and concludes that "among flycatchers, the less accessible the nest, the slower the development of the eggs and young it shelters." Hole-nesting ducks take longer to hatch their eggs than do those nesting in the open: 30 days for Wood Duck (*Aix sponsa*), and Golden-eye (*Bucephala clangula*) in contrast to 25 to 26 days for the Tufted Duck (*Nyroca fuligula*) and 22 to 23 days for the Pintail (*Anas acuta*).

In many cases, of course, there is a general relationship between body size and length of incubation, especially in one group. Much larger birds often incubate longer than smaller ones, as in some Anseriformes, Galliformes, Falconiformes, Strigiformes, Psittaciformes, and Passeriformes (Corvidae in contrast to most of the other open-nesters in this order). But even in one genus, species of widely differing size may have the same incubation period, as the swans listed in table 4. The 48-gram egg of the Peregrine Falcon (*Falco peregrinus*) hatches in the same length of time as the 21-gram egg of the Kestrel (*F. tinnunculus*). The same is true for different breeds of the domestic fowl, although the eggs may range in size from 30 to 68 grams (Romanoff and Romanoff, 1949:65). A set of eggs of the 9- to 11-gram Hutton Vireo (*Vireo huttoni*) hatched after 16 days of constant incubation by both parents (Miller, 1953), whereas the eggs of the 16- to 18-gram Red-eyed Vireo (*Vireo olivaceus*) hatch after 12 to 14 days incubation by the female alone (Lawrence, 1953).

Woodpeckers nest in holes, yet many of them have very short incubation periods along with fairly long nestling periods, the young staying in the nest until fully developed. The explanation of the short incubation period would seem to be that they hatch a little earlier in the embryonic development than does a passerine, as is evident in pictures of young nestlings (Bussmann, 1946). The Heinroths (1924, II:221) thus describe a newly-hatched Black Woodpecker (*Dryocopus martius*): "Eyes and ears are entirely closed, and the whole animal gives the impression that it had come too early from the egg; this small degree of development corresponds well with the exceedingly short incubation period." The same situation may pertain in some other families of the Piciformes with short incubation and long nestling periods.

Hummingbirds have long incubation periods—16 to 17 days for their tiny eggs. A state of torpidity at night has been recorded in adult hummingbirds: male and female Anna (*Calypte anna*) and Allen (*Selasphorus sasin*) hummingbirds with temperatures of 18.7°C. in males (Pearson, 1950) and a nonbreeding female Estella Hummingbird (*Oreotrochilus estella*) whose temperature dropped to 14.5°C. (Pearson, 1953). The night temperature of four nesting females of this latter species ranged between 36° and 39.7°C., averaging 37.4°C. (99.2°F.). The average night temperature of females of eight passerine species was 39.7°C. (Baldwin and Kendeigh, 1932:158). Temperature readings for 48 hours at a nest of an Anna Hummingbird by means of a thermocouple placed between the eggs showed "no evidence of torpidity in the parent bird while incubating . . . . The nest was generally maintained about 10°C. warmer than the surrounding air" (Howell and Dawson, 1954). The chart shows that hourly temperatures ranged between 16° and 37°C. These figures could perhaps be best compared with temperatures "at the bottom of the nest" in House Wrens; these average 32.9°C. for inattentive periods and 34.4°C. for attentive periods (Baldwin and Kendeigh, 1932: 153). It seems evident that hummingbird eggs receive somewhat less heat than do most eggs whose incubation temperatures have been studied.

Those who believe that size of egg controls length of incubation assume that development proceeds at much the same rate throughout the class Aves. This is far from true, as has been shown by Heinroth (1922), Lack (1948) and others. Long incubation is usually paired with long nestling periods, as evolution may effect the rate of cell division throughout the period of growth. In contrast to Heinroth's belief that long incubation

periods are primitive, Lack (1948:31) makes the interesting suggestion that a slow rate of development might have evolved in some cases as "an adaptation to a scarce and erratic food supply," thus enabling the young to survive periods of starvation. The "swifts and Procellarii" are his chief examples, but he also suggests that this theory might apply to hummingbirds and Falconiformes.

What is the basis of different rates of development, that is, different rates of cell division or different sizes of cells? Kaufman (1929, 1930) found the rate of cell division in chick and pigeon embryos much the same, but pigeon cells were smaller than chick cells and these were smaller than duck cells. All three birds have rapid embryonic development. Byerly *et al.* (1938) studied embryos of bantams and Rhode Island reds and reported comparable growth during the first week, but after that the bantams grew at a "lower" rate than the large breed. Yet they found liver cells were about the same size in both breeds and concluded that there are no "inherent differences in rate of cell division" in the two breeds, hence it is not clear how the greater growth in the larger eggs was effected. If two embryos reach the same stage of development in the same length of time and one is larger than the other, the former must possess either larger cells or more of them.

From the foregoing discussion and the examples presented in tables 3 and 4 it is clear that *the crucial factor in length of incubation is the rate of development of the embryo*. Size of egg sometimes plays a role, but often it does not.

SOME PROBLEMS FOR INVESTIGATION

We now have a considerable body of more or less accurate determinations of incubation periods; yet, considering the number of birds in the world, our knowledge is small indeed. In the Old World the incubation period of such a familiar friend as the White Stork is variously given as 28 to 30 and 33 to 34 days, and such examples can be multiplied easily. In North America the majority of our species could well be studied intensively. We are especially weak on the incubation periods of vultures, eagles, hawks, owls, rails, cuckoos, and woodpeckers.

There are many problems of theoretical interest in this field. Why do river ducks have shorter incubation periods as a rule than diving ducks; falcons than accipiters? Length of incubation in the tropical, temperate and arctic zones should be compared. What is the histological basis of long and short incubations? We need to have some concept of embryology and to realize that after 14 days of incubation a Clapper Rail is a blind, nearly naked creature corresponding fairly well to some newly-hatched passerines.

It is not only the subject of incubation periods for which we have such an appalling array of misinformation in North America, but also for many other topics concerned with nesting. We need to know the clutch size, locality by locality, month by month, year by year, not a meaningless mixture of data from all parts of the country. We need to know which sex incubates; the statements in many of our "standard" books appear to have been set down quite at random. We need to know fledging periods of *undisturbed broods* and the time the young are cared for by their parents. Some material on these subjects of parental care can be found in Nice (1943:69-71) and especially in Kendeigh (1952), as well as a great deal of reliable information in Groebbels (1937) and the British and German handbooks.

CONCLUSIONS

The acceptance of erroneous incubation periods for 2300 years rests upon the stubbornly unscientific bent of the human mind. It takes hard and serious thought to investigate; it demands keen and prolonged observation and experiment, analysis and syn-

thesis, and inductive and deductive reasoning, along with a detached and skeptical attitude and creative imagination. How much simpler for the authority to make a clever guess: since the goose and hen incubate about 30 and 20 days, respectively, here seems to be a law of nature which can safely be applied to the class Aves. And how much easier for everyone else to copy from books and lists these statements based on such a neat law than to undertake the bother of watching the birds in nature or hatching their eggs at home, or even of searching through the journals for the results of other people's first-hand and scientifically reported experiences.

On the subject of incubation periods there have been guessers, copyists and investigators. The chief guessers were Aristotle, Bechstein, Naumann and Bendire; the chief investigators, Evans and Heinroth; the copyists have been legion. Not content with perpetuating the somewhat tentative statements of Aristotle and Bendire as first pronounced, the copyists have magnified the importance of the authorities by consistently omitting the "abouts," with the result that in their versions the original assumptions appear as established facts.

It is impossible to build science on a foundation of heterogeneous mixture of fact and error. Our chief trouble is that we bow to authority instead of cultivating the spirit of inquiry and the habit of evaluating evidence. The non-Aristotelian view of science is well expressed by Johnson (1946:26) who explains how the scientist uses his theory "*as a source of questions*, new questions that have never before been asked by any one. And he uses the new questions to direct himself and others to new observations that have never been made by any one . . . . To be scientific, then, is in a fundamental sense, to ask questions—fresh, meaningful, clear, answerable questions . . . . Our beliefs automatically become questions the moment we realize they are beliefs instead of facts."

This whole problem is a challenging one. We need to watch and study our birds, and to view with suspicion statements unaccompanied with full data as to laying and hatching dates of all eggs in a set. An incubation period is a biological fact, not merely a figure to copy out of a book. As Kirkman *et al.* (1911–1913) said: "To know how little we know is in natural history the beginning of wisdom."

SUMMARY

Confusion still prevails in North American ornithology on the subject of incubation periods. Too short periods are usually attributed to birds of prey, some shorebirds, rails, terns, hummingbirds, and cowbirds, and too long periods to woodpeckers, cuckoos and some passerines.

By incubation period is meant the time required in regular incubation of a newly-laid egg until the young has left the egg.

Aristotle was responsible for the original belief in short incubation periods for birds of prey. He was copied throughout the history of ornithology until late in the 18th century, after which Bechstein and the Naumanns applied to all birds the principle of incubation period matching the size of bird. At the end of the 19th century William Evans investigated this subject with the aid of the incubator and published his findings on 81 species. In 1922 Heinroth published the second great contribution to this field. Recent publications on birds of Great Britain and northern Europe present on the whole reliable information on incubation periods.

In the New World before 1892 only one author, Gentry (1876, 1882) mentioned any large number of incubation periods; these were excessively brief. Charles Bendire (1892–1895) played the key role in the field of reporting incubation periods in North America. He assigned about 28 days to the larger hawks (including Golden Eagle) and

owls, and graded down to about 21 days the incubation periods for smaller raptors and even to about 14 days for the Elf Owl. Some of his periods for cuckoos and passerines were too long. The majority of his guesses were wrong. Yet they have been accepted as facts up to the present. They form the chief basis for incubation periods of North American birds in our most quoted lists, state books, and other compilations.

No reliance can be placed on the lists of incubation periods published by Burns (1915) and Bergtold (1917).

Careful studies have been made on a certain number of species. Skutch (1945) has published incubation and nestling periods of a large number of Central American birds, and Kendeigh (1952) gives much reliable material. Persistent errors in this field concerning 21 New World species are summarized.

Neither longevity nor temperature of the parent is correlated with length of incubation. Within a group, size of egg may or may not have an influence. In general, length of incubation cannot be said to depend on size of bird or egg. Long incubations are found where the brood runs little danger. Heinroth considered slow development a primitive trait, but Lack suggests it may have evolved in some forms in response to an uncertain food supply. The critical factor determining length of incubation is rate of development of the embryo.

The principal figures in this tragedy of errors—Aristotle, Bechstein, the Naumanns and Bendire—assumed that length of incubation must correspond to size of bird or egg, and because of their prestige, this assumption was unquestioningly accepted by the majority of subsequent writers. In the search for truth it is essential to demand the evidence.

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Chicago, Illinois, February 17, 1954.

WILD TURKEYS IN CENTRAL COASTAL CALIFORNIA

By GEORGE V. BURGER

The Wild Turkey (*Meleagris gallopavo*) did not exist in California at the time of discovery and settlement. In an attempt to establish these game birds for hunting purposes in California, the State Division of Fish and Game undertook a series of introductions of turkeys, beginning about 1910 and continuing until 1951.

In 1951 the writer conducted a study of these introductions under the guidance of Dr. A. S. Leopold. The investigation consisted of two parts—a statewide survey of all introductions, and an intensive local study of an established population on the Castro Valley Ranch, situated approximately six miles southwest of Gilroy, Santa Clara County. The results of the statewide survey have been published separately (Burger, 1954). The present report deals with details of the life history and ecology of the Castro Valley population.

The population.—A total of 49 turkeys was released at the Castro Valley Ranch, 31 in 1939 and 18 in 1946. The birds were brought in as poults from the Yountville State Game Farm and were raised in pens at the ranch until old enough for release. The exact genetic makeup of these birds, like most game farm turkeys, is not known. They evidently originated from a hybrid strain obtained by crossing the wild Merriam subspecies (*M. g. merriami*) with various semi-domesticated stocks.

The turkeys did well from their first release, increasing rapidly and spreading farther to the west each year. The actual range occupied by the population has fluctuated, and the present distribution (1951) is not as extensive as it has been in the past. At their peak of dispersion the turkeys ranged over an area of about 14 square miles. By 1951, however, their range had been reduced to about 6 square miles, with the bulk of the population concentrated on the Castro Valley Ranch proper.

The population was censused by the writer. A complete census was attempted rather than a sample count. Detailed notes were kept on all flocks seen, including the number of birds, the age and sex composition, and the exact location. On the basis of such material, a minimum of 187 different birds was observed during the spring, summer, and fall of 1951. In addition to the turkeys which were actually seen, signs and reports of other flocks indicate that the total population in 1951 was perhaps 250 to 300 birds.

Population density is thus extremely high, being about 40 birds per square mile. This is considerably greater than the maximum densities for Wild Turkeys reported from other states.

Habitat relationships.—The region occupied by this turkey population lies in the Transition and Upper Sonoran life zones and consists of rolling mountain terrain reaching an elevation of 1400 feet on the northwest and sloping gradually down to the Santa Clara Valley on the southeast. Rainfall is moderate and is confined to late fall, winter, and early spring.

The principal upland cover consists of the coast live oak (*Quercus agrifolia*) interspersed with grassland in varying proportions. Mixed stands of redwood (*Sequoia sempervirens*) and madrone (*Arbutus menziesii*) occur commonly in the canyons and on the moister upland soils. At lower elevations typical riparian trees and shrubs are found along the stream beds. Chaparral occurs in scattered but dense stands. Several small streams on the ranch furnish a water supply which has been artificially controlled by pipelines and by the creation of several ponds so as to furnish a year-round supply of fresh water over most of the area.

The various cover types, the principal plant species of which they are composed,

and the relative use made of them by the turkeys, as observed by the writer, are shown in table 1.

The dense redwood-madrone stands were used for purposes of concealment and escape throughout the entire period of study. Canyons containing such heavy cover border most of the upland feeding areas, and turkeys were often observed flying or running the short distance down to the canyon bottoms when alarmed.

Table 1
Important Cover Types and Their Uses at the Castro Valley Ranch

Cover types	Principal use by turkeys				Important constituent species
	Feeding	Escape	Nesting	Loafing	
Oak woodland	xxx	x	xxx	xxx	White oak, coast live oak, toyon, bay tree.
Redwood-Madrone		xxx	x	x	Coast redwood, madrone, oak spp.
Chaparral		x		x	*Baccharis* spp., *Rubus* spp., *Diplacus aurantiacus.*
Riparian woodland	x	xx	x	x	Western sycamore, alder, willow spp., box elder.
Grassland	xxx		x		Many species of perennial forbs and grasses.

Key: xxx—heavy use; xx—moderate use; x—light use.

There is some use of chaparral during the early summer, primarily on the part of hens with broods of half-grown young. Such broods frequently seek shelter in the dense brush stands, especially where cattle or deer have opened narrow trails making the brush more accessible. This was the only use made of chaparral by Wild Turkeys noted during eight months of my observations.

To determine the relative use made by turkeys of the main types of feeding cover on the ranch, the cover utilized by each flock observed from April to November was noted. Percentages of use were then determined and charted for this seven-month period, and the results are illustrated in figure 1. The data upon which this figure is based were obtained during 18 days of observation over the seven-month period. During this time 69 separate observations of turkeys were recorded by the writer. In addition, approximately 20 accurate reports were made throughout the year by Mr. Harold S. Chase, owner of the ranch, and his foremen.

A definite seasonal pattern appears in figure 1, indicating a shift in feeding habits. In the spring most foraging occurs along the borders of grassland-live oak areas or in small parklike grass patches in the centers of rather dense oak stands. Observations of feeding and the examination of droppings indicate a preponderance of green plant material and a few small insects in the diet. At this time of year water is still fairly abundant in the upland areas where this type of cover occurs, and grasses and forbs are still green.

In midsummer a marked shift was noted and most feeding activities centered on open grassy slopes. These afforded only a small amount of escape cover, usually in narrow, brushy draws and ravines. Three changes probably contribute to this shift. First, the upland water supply is then scant and rainfall practically nonexistent, so that the green parts of plants have dried beyond use. Second, range grasses and annuals are in seed, and large numbers of short-horned grasshoppers are present, both furnishing turkey food. Finally, the broods of young are large enough to venture safely into more open terrain. As a result, most of the birds are feeding upon various seeds and grasshoppers, as was noted again from droppings and by actual observations. Stream bottom areas now come into greater use, both for feeding and for their water supplies. Oak-grassland

borders are still frequented, but with much less regularity than earlier in the year.

By late August, after the prolonged summer dry spell, most of the upland water sources are dry, herb seeds and grasshoppers are few, and the winter mast crop has not yet fallen. At this time a second shift in habitat occurs among most of the turkeys. Large numbers of birds move out of the upland areas, probably because of food and water shortages, and begin to appear near ranch headquarters in the lower portions of the range. Here the birds concentrate in large numbers in the well-watered permanent

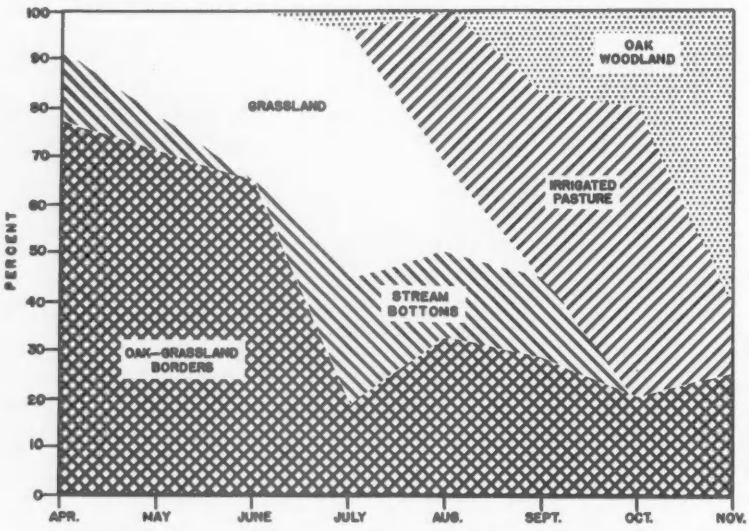

Fig. 1. Seasonal use of feeding cover by Wild Turkeys, Castro Valley Ranch, 1951.

pastures and orchards, and around hay piles, wherever seeds and grasses are still available and water plentiful. This movement has occurred regularly each fall since 1939 and is a striking characteristic of the population. Not all of the birds participate in this shift, about one-third of the population remaining in the upland areas. It seems apparent from these facts that during the late summer the upland habitat cannot support the high population maintained there during the rest of the year due to the pronounced shortages of food and water.

If this assumption is correct, the high population density on the Castro Valley Ranch probably could not be maintained without the presence of irrigation systems and their attendant sources of water and food, so essential to the turkeys in the fall. It seems clear that the period from late August to mid-September is the critical time for the population. The lack of water and shortage of certain foods during this season may be the factors limiting the size and expansion of this population and, in addition, may well be responsible for the failure of the vast majority of attempted introductions of Wild Turkeys throughout the central and southern coastal regions of California.

Beginning in mid-September an increasing utilization of open oak stands becomes evident. Such cover is used to some extent throughout the year, but serves primarily for loafing grounds during the spring and summer. In the fall the acorn crop begins to appear and the first rains commence. At this time the birds begin to move back into the

uplands. At first a few small bands move out on short foraging trips of one or two days' duration. Later all the birds leave the valley. In 1951 the main flock left ranch headquarters about November 28; in 1952, November 15; and in 1953, December 1. At this point the critical water and food shortages are at an end and once more the uplands seem capable of supporting a large turkey population.

Since no observations were made by the writer from December to April, the percentages of use of vegetation types for this period were not determined. From the trends indicated, however, it would seem that open oak groves, with their acorn supplies, would constitute the main feeding cover until the appearance of green grass, annual shoots, and insects permitted an early spring shift to oak-grassland borders.

A cover type utilized throughout the year and not appearing in figure 1 consists of roosting trees. Reports and observations indicate a preference for redwoods and large oaks in this area, both occurring in canyon sites. The writer observed a group of 15 turkeys, all males, going to roost in a clump of three large valley oaks (*Quercus lobata*) in a lowland area, and under other stands of these trees accumulations of droppings indicated frequent roosting use.

No stomach analyses were made during the survey; hence no exact food preferences could be determined. Fairly accurate clues were obtained, however, from examinations of droppings, a technique developed by Dalke *et al.* (1946) in Missouri, and from actual observations of feeding birds. The general trends revealed by these methods were indicated in the foregoing discussion. As was pointed out, spring foods consist mainly of green plants and insects; summer feeding is mainly on grasshoppers and various herbaceous seeds; winter choices include acorns and other mast crops. This is fairly typical among all populations of Wild Turkeys.

Seasonal events.—The general sequence of events in the annual cycle of turkeys at the Castro Valley Ranch is shown in figure 2. This figure and the discussion which follows are based upon 69 separate observations by the writer on 18 days of observation from April through November. The material from December through March is derived from reliable reports by Mr. Chase and his foremen.

During the observations in mid-April gobbling was heard often during the early morning and evening. Courtship displays were frequently observed during this period, and an elaborate duel between two gobblers was recorded on April 21. All of these activities occurred in upland, oak-bordered clearings. The first gobbling and courtship were noted during the last week in February by Mr. Chase and his foremen. Gobbling was noted at each observation period until the last week in July, and an actual mating was observed on July 13. After early May, however, all indications of mating diminished steadily. The mating season in 1951 thus lasted from February until late in July, but the peak was reached in the month of April.

Pure strain Wild Turkeys do not breed as yearlings, but as Leopold (1944:60) points out, domestic year-old males will breed readily. The breeding tendencies of males in this population should thus offer some indication of the "wildness" of this game farm stock. It is interesting, therefore, to note that all mating and courtship activities and associations with females observed by the writer were carried out by the large adult gobblers. None of the yearlings observed took part in breeding activities.

Figure 2 indicates that nesting commences in the latter part of March and reaches a peak shortly after the first of April. The duration and intensity indicated are derived from the times of the appearance of the young, since no nests were found by the writer in the course of the observations. The smaller, second peak in incubation activity which appears in figure 2 is derived in the same fashion from the appearance of a few late

broods, about which more will be said later. One late nest containing seven fertile eggs was reported by the owner of an adjoining ranch, being discovered on June 29. This nest was located at the boundary of an open hay field and an oak woods, placed a few feet out into the field. Nesting sites of previous years were pointed out to the writer and were generally located near the edges of fields or paths. All were near fresh water. Such sites are typical of those chosen by most Wild Turkeys in other regions (Mosby and Handley, 1943:114).

The incubation period lasts 28 days in the Wild Turkey, and at the Castro Valley Ranch the first young birds began to appear in May in 1951. Downy young less than a week old were first noticed on May 10 by the ranch foreman. During the period June

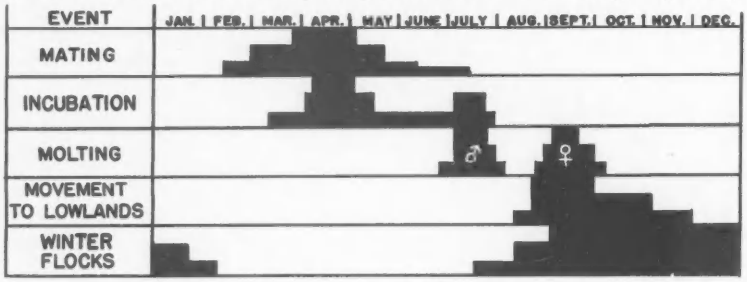

Fig. 2. Seasonal events in the annual cycle of the Castro Valley Ranch turkey population, 1951.

20 to June 25 the writer observed over 60 different young poults, ranging in age from about 2 weeks (only two birds this young were seen at this time) to 6 to 8 weeks of age. The majority were about 5 to 6 weeks old, which indicated that hatching reached a peak in the middle of May.

For the first few weeks after hatching, before the young are able to fly capably, each hen and her brood remain apart from other turkeys. During this critical period the hens were particularly cautious and attentive. The following quotations from the writer's field notes illustrate the care given the young and the control by the hens of their broods.

June 20, 4:20 p.m.: "Surprised a hen and her two small downy poults feeding in a grassy clearing within 10 yards of live oaks. On sighting me, the young froze into the tall grass while the hen walked back and forth at the edge of the oaks, clucking loudly every few seconds. I stopped and sat motionless just within sight. The hen kept pacing about under the trees, just far enough downhill so that I could only see her head now and then. She continued clucking and pacing and the young remained motionless for about 10 minutes. At this time the hen calmed down, stopped clucking, and walked rapidly into the oaks toward denser shelter, her young immediately appearing from their place of concealment and following silently."

Another observation points out the excellent protection given the young at this age by their color and behavior. June 25, 6:20 p.m.: "While I was walking along the upper road, the head of a turkey popped up suddenly about 6 inches above the grass in a clearing about 30 yards ahead, and was as quickly withdrawn. I approached cautiously until a large hen flushed, flew a few yards, and then ran rapidly into oak cover a short distance away. She remained in these oaks and it was obvious from her behavior that her young were concealed nearby. I walked back and forth over the area where she had lain (drying grass about a foot high) but saw nothing. The hen finally flew downhill into a large redwood and I left the clearing. Returning 10 minutes later I again searched

the area to no avail. I concealed myself at some distance and after about 5 minutes more could hear the hen calling. At this call two downy poults moved rapidly out of the grass where I had twice searched for them and joined their mother in the oaks." In this case it seems probable that the hen was preparing to spend the night on the ground, sheltering her two poults which were too young to fly. These young birds remained motionless for a total of 25 minutes until "released" by the command of the hen, although the writer must have passed within a yard of them several times. Their obedience and concealment were perfect.

At the age of about 3 to 4 weeks the young birds can fly well enough to roost in low trees during the night. At the end of six weeks, when the juvenal feathers have appeared, members of several broods begin to associate in larger flocks. The first such unit was noted June 21 in 1951 and consisted of 4 hens and 20 poults. Groups of this type, ranging in size from 2 hens and 3 young to 5 hens and 30 young, were seen frequently during the summer. At this time feeding, as mentioned, shifts to grassy slopes where the flocks spread out abreast in a long line foraging for grasshoppers.

While the young are developing under the care of the hens, the males form small summer associations, with adults and yearlings often mixed, and frequently joined by hens without broods. As indicated in figure 2, the males are now in molt, a process which apparently takes place in July, since one band was observed in molt July 13 and its members were still in the process July 26. Most of the hens molt during September. Both gobblers and hens are cautious and secretive during molting.

In late August, two or more of the large bands of hens and young may unite. Later in the fall these groups are joined by many of the old males, some of the yearling males, and most of the unsuccessful hens. In this fashion the large winter mixed flocks build up. Winter flock formation coincides with the shift from upland areas to well-watered lowland pasture sites mentioned earlier. The main winter flock first appeared at ranch headquarters on August 22 in 1951 and was observed on several occasions from late August to mid-November. In this period the number of birds seen varied from 40 to 101, some units apparently detaching and foraging in nearby areas for brief periods. One typical count of this flock, made September 30, revealed a total of 73 birds, made up of 7 old gobblers, an undetermined but smaller number of yearling males, and a group of 9 apparently unsuccessful hens, with successful hens and their young of the year constituting the remainder.

Between the middle of November and early December, as mentioned, the birds desert the immediate vicinity of the ranch headquarters and move back toward the uplands. By February, according to reliable reports, the large flocks have broken up.

Daily activities.—Feeding was observed mainly during the early morning and late afternoon over most of the April-November period. This was especially true on hot sunny days, when activity almost ceased from about 10:30 a.m. until nearly 4:30 p.m. Heavy dews and fog restricted the early activities of hens with young on some mornings, but old gobblers were observed feeding in a heavy low fog by 7:00 a.m. one morning.

During mid-day in summer the birds sheltered under open oaks, with occasional brief foraging trips along the borders. On cool or cloudy days, and in the early summer and late fall, the demarcation between feeding and loafing periods was less pronounced, and the birds foraged most of the day. Feeding activity was always high in the twilight hours, until the fall of darkness sent the birds to roost.

Losses of young.—Since broods of young were observed at regular intervals during the summer, it was possible to determine rather accurately the rate of loss during this period. Figure 3 shows these data, the graph being based upon the average number of

poults per successful hen seen on various dates. Observations from which these data were derived were made June 20–21 (11 hens and 54 young), June 25–26 (10 hens and 43 young), July 12–13 (12 hens and 36 young), and July 26–27 (5 hens and 16 young). The starting point of ten eggs is the average clutch size as determined by a number of investigations on eastern and southwestern races of the Wild Turkey. Losses of a portion of the eggs due to infertility and accidents are thus automatically included. Figure 3 does not measure total mortality, of course, since it does not include broods which were completely destroyed. Such a complete determination is impossible since there is no

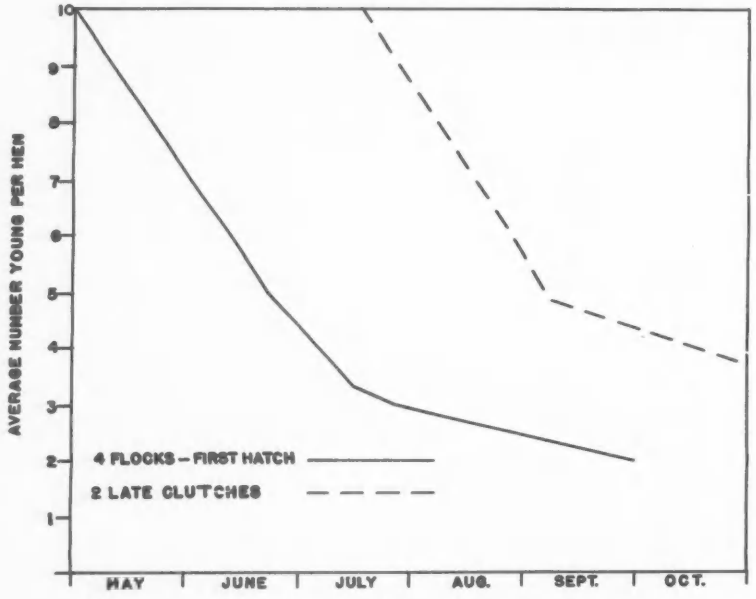

Fig. 3. Decrease in brood size after hatching, Castro Valley Ranch, 1951.

known method for distinguishing unsuccessful hens from those which did not attempt to breed.

Wild Turkeys do not raise two broods of young in one season. Hens having their first clutch destroyed may make a second nesting attempt, however. Two such late broods were observed at the ranch, the first August 24, consisting of a hen and 7 poults about 6 weeks old, and the second August 26, consisting of a hen with 12 young about 3 weeks old. Losses among these late broods followed the trend of earlier groups. Thus the brood of 12 diminished to 9 on September 6 and was reduced to 4 by October 19.

As can be seen, most brood losses occur during the first two months after hatching, when the poults are small and most susceptible to predation and exposure. After about the eighth week only a few young are lost and few deaths may be expected normally beyond the age of 5 months.

The population as a whole apparently had slightly better success than the flocks upon which figure 3 was based, since the composition of the large winter flocks (when

the young were about 5 months old) revealed approximately 3.7 young per successful hen.

Since no remains of young birds were found during the investigation the actual causes of mortality could not be fixed. Chilling and exposure to moisture result in fatalities among young turkeys elsewhere and presumably operate here as well. Trapping records kept by Mr. Chase and sign observed by the writer indicate that coyotes, bobcats, skunks, foxes, and feral cats and dogs are to be found on the ranch. Such predators are known enemies of young turkeys, and may account for many of the losses.

Table 2

Sex and Age Composition of the Castro Valley Ranch Population in 1951

Sex and age groups	Actual number	Per cent of adult population	Per cent of fall population	Number per 100 females
Old males	14	20	7.4	32.5
Yearling males	13	18	6.9	30.2
Total—males	27	38	14.3	62.7
Females with young	31	44	16.5	.....
Females without young	12	17	6.4	.....
Total—females	43	61	22.9	100
Total—adults	70	100	37.2	.....
5-month young	117	....	62.8	272
Total population	187	....	.....	.....

Sex and age composition.—Table 2 indicates the sex and age composition of the population, insofar as these factors could be determined. The data are based upon 187 birds classified during the course of the study. Since this number includes about 75 per cent of the minimum number of turkeys estimated to be present on the ranch, it is believed to be representative of the entire population.

Among the adults a sex ratio of 62.7 males per 100 females was found, gobblers thus making up about 38 per cent of the adult population in 1951. However, nearly half of the males were yearlings which showed little or no tendency to breed. Therefore there were only 32.5 breeding gobblers for every hundred hens, or a ratio of approximately 3 to 1. These estimates are comparable to sex ratios reported for Wild Turkey populations in other states.

About 17 per cent of the adult population consisted of females which produced no young during 1951, being either barren or unsuccessful.

In the fall there were about 272 young per 100 females. This figure represents the estimated productivity of the Castro Valley Ranch population. This means there were about 3.7 young raised per successful hen.

"Wildness."—One further aspect of this population deserves mention. This is the matter of wildness, or the effect of the hybrid nature of game farm stock on their subsequent behavior and success. Aside from the tameness of certain individual birds and the close approach to the ranch buildings in the fall, these turkeys show other indications of their hybrid origin. The most noticeable of these is their tendency to form large flocks, reaching 101 birds in one case. Groups of this size are rarely reported among Wild Turkeys and may be taken as an indication of mixed blood wherever they occur (Leopold, 1944). On the other hand, the care and control demonstrated by the hens over their broods, and the lack of any evidence that yearling males participate in breeding activities, indicate a considerable degree of wildness in this population.

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PLEISTOCENE BIRDS FROM THE JONES FAUNA OF KANSAS

By THEODORE DOWNS

Avian skeletal remains have not been described from the Pleistocene of Kansas except in a brief abstract summarizing the results reported here and dealing with the Jones avifauna (Downs, 1949). Other paleontological studies of vertebrates from Kansas mention the occurrence of avian elements only in faunal lists. Our knowledge of birds from the Pleistocene in central North America is relatively meager compared to that of the western and southeastern portions of the continent. It is worthwhile, therefore, to present this account of birds taken from the Jones fauna of Kansas even though relatively few specimens are available and no new forms are described.

The material which is the basis for the present study was obtained in Meade County, western Kansas, by Claude W. Hibbard and members of his field parties. The locality is University of Kansas loc. no. 13 (Hibbard, 1940:417). This area is also referred to as the Jones sink (sec. 8, T 33 S, R 27 W; see Smith, 1940). The fauna is generally considered to be late Pleistocene in age.

Avian specimens from this fauna were sent by Dr. Hibbard, formerly at the University of Kansas, to A. H. Miller of the University of California Museum of Vertebrate Zoology for study by Dr. Miller or his associates. It was the author's privilege to examine this material and benefit from Dr. Miller's invaluable assistance during the course of the study. The writer is also indebted to Dr. Hibbard, now of the University of Michigan, for criticisms and for providing information on the geology and stratigraphy of the area. R. A. Stirton and Morgan Harris, both of the University of California, and Hildegarde Howard of the Los Angeles County Museum have given helpful criticism and advice in the preparation of the manuscript. D. Dwight Davis of the Chicago Natural History Museum, Herbert Friedmann of the United States National Museum, and their respective institutions graciously permitted the use of material for comparisons. I wish to express thanks to Mrs. Theda C. Downs for assistance in typing and checking many parts of the manuscript.

The stratigraphy and vertebrate paleontology related to the Jones fauna have been studied by Hibbard (1949*a*). It is his conclusion that the fauna may be correlated with the upper part of the Vanhem formation, late Pleistocene age. The deposit occurred in in a simple, isolated sink-hole fill probably not more than three miles in diameter, according to Smith (1940). The bird material was taken from a narrow stratum of sand of high lime content in a deposit not over fourteen inches thick at the center and lensing out to a periphery varying in thichness from six to four inches. In the section outlined by Hibbard (1940), the Jones fauna is about thirteen feet below the top soil in a sixty-one foot exposure along Sand Creek. After nearly filling with sediment, the original sink was tapped by Sand Creek. The dissection of the sink occurred in very late Pleistocene or in the early Recent.

Today sink-holes may develop with a rapid "collapse" as demonstrated in the recent Meade salt sink appearing in 1879 south of Meade, Kansas. This hole had an original depth of about eighty-nine feet, and salt water rose to within fourteen feet of the surface. Ground water and surface precipitation soon replaced the salt water (Johnson, 1901). It is known from recent observations that the walls or sides of sinks are attacked quickly by erosion. Many gullies and subsequent extension of the sink areas develop, followed by formation of gentler slopes and filling of the collapsed area to produce level bottoms in the sinks. It is also possible, according to Frye (1942), that the process of sink formation could occupy considerably more time than the period required for the type of simple collapse development discussed here.

Vertebrates other than birds and invertebrates have been described and referred to the Jones fauna. The fossil flora is not known. Hibbard (1940) published the first description of the fauna, including a summation of work by Goodrich (1940), who identified several mollusks. Of particular interest is the presence of the mollusk *Lymnaea stagnalis* subsp., which is represented by *L. s. appressa* today at Gunnison, Colorado, the locality nearest the Meade County site. The presence of *Lymnaea stagnalis* subsp. suggested to Goodrich that there were waters colder the year round than now exist in southwestern Kansas. Tihen (1942) has given a complete analysis of the high concentration of 1250 or more fossil individuals of neotenic *Ambystoma tigrinum*. He has suggested that these remains represent a large colony that was exterminated with the drying of the sink. He notes the similarity in size of these amphibia with neotenic specimens from Colorado Springs, Colorado.

Hibbard has reported on the mammalian fauna (1940, 1942, 1943, 1949*a* and 1949*b*). *Sorex cinereus* Kerr, *Citellus richardsonii* (Sabine) and *Microtus pennsylvanicus* (Ord) were most abundant and represent a more southern distribution than that of today. Other rodent species included are: *Citellus tridecemlineatus* (Mitchill), *Cynomys ludovicianus* Ord, *Geomys* sp., *Perognathus* sp., *Onychomys leucogaster* (Wiel), and *Peromyscus* sp. Carnivora reported are *Mephitis mephitis* (Schreber) and *Taxidea taxus* (Schreber). A tayassuid artiodactyl, *Platygonus* sp., was present as also *Camelops*, both of which are now extinct.

METHODS

Single specimens of isolated skeletal elements were the only fossil materials available for many of the identifications, and this increased the necessity for care in discerning individual differences as opposed to species distinctions. Different bones within the various families and orders of birds display varying degrees of usefulness in differentiation. Recent species that are difficult to separate on the basis of external features prove even more difficult to separate by means of single elements of the internal skeleton. Generic identifications of single fossil elements might have been given a specific designation if a complete skeleton had been available. Qualitative features such as relative positions of tuberosities or depth of fossae proved to be as important as quantitative data in showing probable genetic differences or affinities between living species and the fossils. When practical to do so, measurements of bones were made. If gross size distinctions between a fossil bone and a living species were obvious, the latter species was immediately eliminated from consideration. Comparisons with extremes and averages of series of measurements of recent species were made where differences could be satisfactorily determined from such data. In many instances in the study, determinations of statistically significant distinctions between measurements were made using either of two formulae: comparison of the single fossil specimen with a large sample, or a single specimen with a small sample (Simpson and Roe, 1939:188, 203). It is impractical, for the present, to attempt to include all of the data on measurements of the recent avian skeletons used in this study.

Morphologic terminology follows Howard (1929). The initials UKMNH refer to material from the University of Kansas, Museum of Natural History.

SPECIES ACCOUNTS

The order of classification follows the American Ornithologists' Union Check-list (1931) with the following exceptions: I follow Delacour and Mayr (1945) in the classification of the Anatidae and Peters (1934) in the placement of the subfamily Arenariinae in the family Scolopacidae.

FAMILY COLYMBIDAE (fig. 1).

Colymbus caspicus Hablizl. Eared Grebe. Complete (except for slight chipping at distal end) carpometacarpus; UKMNH no. 5676. Although slightly smaller than the means or extremes of measurements of the total length of carpometacarpi of *Colymbus caspicus, C. auritus* and *Podilymbus podiceps* (see table 1), this specimen shows no significant difference from *C. caspicus* in the total complex of characters. The pollical facet and metacarpal 1 are larger in *C. auritus* and *P. podiceps*. *P. podiceps* is distinct in having a shorter and more angular posterior edge of the external flange and carpal trochlea.

Table 1

Comparison of Total Length of Carpometacarpus No. 5676 with Samples of Recent Colymbidae

Species	Number of specimens	Mean	Observed range	Standard deviation	Dimensions of fossil specimen	Difference[1] / Stan. dev.	P[1]
Colymbus auritus	8	33.75±0.37	32.1–35.0	1.04	28.8	4.7	<.01
Colymbus caspicus	18	30.88±0.19	29.7–32.5	0.82	28.8	2.0	<.05
Podilymbus podiceps	14	33.50±1.50	31.2–37.1	2.98	28.8	1.6	.....[2]

[1] See Simpson and Roe, 1939:137, 191, 206.
[2] Not significant.

FAMILY ANATIDAE (fig. 1).

Anas acuta Linnaeus. Pintail Duck. Incomplete proximal ends of coracoids, UKMNH nos. 5644 and 5641. *Anas americana* closely resembles the fossils but differs in having a more deeply excavated triosseal canal; slightly longer and more posterior glenoid facet (as viewed ventrally); slightly greater extension of the brachial tuberosity beyond the shaft contour; and slightly deeper and narrower brachial notch. *A. acuta* is similar to the fossils in size (see table 2) and in the features noted above (also see fig. 2 for comparisons).

Anas Linnaeus. Teals. One anterior part of the coracoid, UKMNH no. 5679; three carpometacarpi, UKMNH no. 5649 complete, no. 5668A distal fragment, no. 5647 proximal half; two tibiotarsi, UKMNH no. 5683C distal, no. 5683B proximal. None of these specimens can be identified specifically. The single coracoid seems to show marked resemblance to *Anas cyanoptera*, whereas the other elements are nearer *A. carolinensis* and *A. discors*. It seems that at least two species of teals were present in this avifauna.

Anas clypeata (Linnaeus). Shoveller Duck. One nearly complete coracoid, UKMNH, no. 5639. With the exception of a slightly longer glenoid facet, the fossil is remarkably similar to Recent specimens of *Anas clypeata* in the characters compared (see table 3 and fig. 2). *Aythya affinis* is closely related but shows distinction in: significantly greater length; greater ventrad angulation of the anterior

Table 2

Comparison of Coracoid No. 5644 with Samples of Closely Related Anatidae*

Characters	Number of specimens	Mean	Observed range	Standard deviation	Dimensions of fossil specimen	Difference / Stan. dev.	P
Head thickness							
Anas platyrhynchos	7	5.42±0.16	4.8–6.1	0.43	4.4	2.4	.05
Anas acuta	33	4.82±0.52	4.1–5.5	0.30	4.4	1.4	.....
Anas americana	9	4.72±0.07	4.4–5.1	0.21	4.4	1.5	.....
Anterior width							
Anas platyrhynchos	7	10.85±0.36	9.0–11.5	0.96	9.1	1.8	.....
Anas acuta	33	9.54±0.14	8.5–10.5	0.84	9.1	0.5	.....
Anas americana	9	8.92±0.12	8.4–9.7	0.35	9.1	0.5	.....

* See footnotes of table 1.

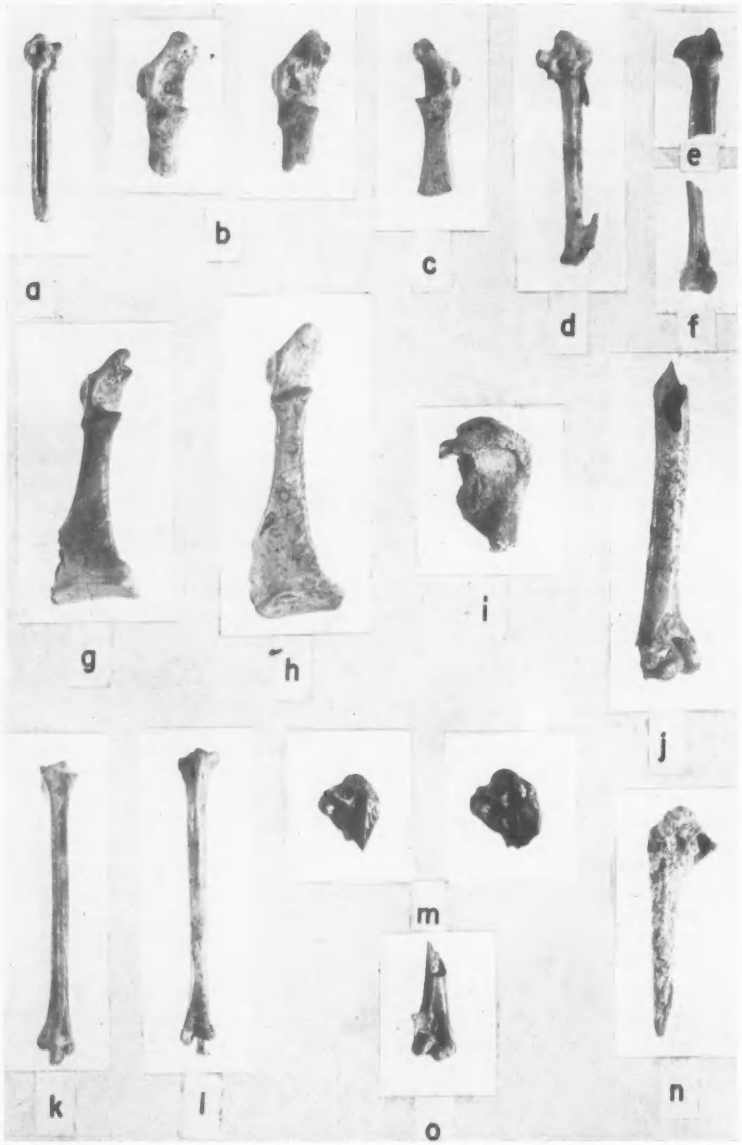

Fig. 1. Bones of Pleistocene birds from the Jones Fauna of Kansas. All photos × 1. *a, Colymbus caspicus,* UKMNH no. 5676; *b, Anas acuta,* anterior coracoids, UKMNH nos. 5641 and 5644; *c, Anas* (teal), anterior coracoid, UKMNH no. 5679; *d, Anas* (teal), carpometacarpus, UKMNH no. 5649; *e, Anas* (teal), tibiotarsus, UKMNH no. 5683B; *f, Anas* (teal), distal tibiotarsus, UKMNH no. 5683C; *g, Anas clypeata,* coracoid, UKMNH no. 5639; *h, Aythya,* coracoid, UKMNH no. 6052; *i, Aythya,* proximal humerus, UKMNH no. 5652; *j, Aythya,* distal humerus, UKMNH no. 6057; *k, Bartramia longicauda,* anterior view of tarsometatarsus, UKMNH no. 6394; *l, Bartramia longicauda,* posterior view of tarsometatarsus, UKMNH no. 6394; *m, Bartramia longicauda,* proximal humeri, UKMNH nos. 5653 and 5654; *n, Bartramia longicauda,* proximal humerus, UKMNH no. 5659; *o, Bartramia longicauda,* distal humerus, UKMNH no. 5655.

portion of the coracohumeral surface; greater distance between the intermuscular line and edge of the shaft; and longer glenoid facet.

Table 3

Comparison of Coracoid No. 5639 with Samples of Recent Anatidae*

Characters	Number of specimens	Mean	Observed range	Standard deviation	Dimensions of fossil specimen	Difference / Stan. dev.	P
Total length							
Anas cyanoptera	7	34.99±0.28	33.8–35.8	0.75	38.0	4.0	<.01
Anas americana	9	42.20±0.33	40.5–43.5	1.00	38.0	4.2	<.01
Anas clypeata	6	40.00±0.62	38.1–42.2	1.51	38.0	1.3	.....
Aythya affinis	12	43.00±0.37	41.1–44.5	0.96	38.0	5.2	<.01
Head thickness							
Anas acuta	33	4.82±0.08	4.1–5.5	0.43	3.7	2.6	<.01
Anas americana	9	4.72±0.07	4.4–5.1	0.21	3.7	4.9	<.01
Anas clypeata	6	4.02±0.08	3.7–4.3	0.21	3.7	1.5	.....
Canal width							
Anas cyanoptera	7	4.57±0.05	4.4–4.7	0.02	5.6	5.2	<.01

* See footnotes of table 1.

Aythya Boie. Scaup Ducks. Three coracoids, UKMNH no. 6052, nearly complete and nos. 6170 and 5642 incomplete; two fragments of humeri, UKMNH proximal portion no. 5652 and a distal piece no. 6057. Coracoids of surface-feeding ducks of the tribes Anatini and Cairinini are distinct from the fossils and from *Aythya* in the lesser degree of twist or angulation of the head of the coracoid relative to the longitudinal axis of the shaft. This feature is most readily observed from an anterior view. Other features of the coracoids suggest relationship to *Aythya*, also; specific identification, however, is not possible.

The proximal humeri cannot be distinguished from *Aythya marila* or *A. affinis* in any of the features compared. The distal humerus (no. 6057) resembles *Aythya* in many features, but the attachment of the anterior articular ligament is broader and the scar for the pronator brevis is more palmar in position in *Aythya* than in the fossil.

Because of similarity in size, these fossil coracoids and humeri are more likely to be related to *Aythya marila, A. affinis* or *A. collaris* than to *A. americana*.

Aythyini, indeterminate. Distal end of humerus UKMNH no. 5662 and proximal end of tibiotarsus no. 6054. The small size of the humerus, the position of the pronator brevis scars and shape of the brachial depression suggest possible affinity with *Bucephala albeola*, the Bufflehead. The tibiotarsus appears to be distinct from species of the tribes Anatini and Cairinini in that the flexor attachment is opposite rather than proximal to the fibular crest, and the external articular facet is highly convex.

FAMILY SCOLOPACIDAE (figs. 1 and 5).

Bartramia longicauda (Bechstein). Upland Plover. Nearly complete tarsometatarsus, UKMNH no. 6394; proximal ends of humeri nos. 5653, 6554 and 5659, distal end of humerus no. 5655. The tarsometatarsus, no. 6394, has the trochleae eroded, and the calcaneal ridges of the hypotarsus are absent (except the inner ridge). The only species of shore bird that has dimensions equal to this fossil tarsometatarsus is *Bartramia longicauda* (see table 4). Other qualitative features of the fossil are nearly identical to this species. The humeri strongly resemble *B. longicauda* in size and in the several characters compared in figs. 3 and 4.

There were at least two individuals of this species in the fauna. This is the first record of the genus as a fossil.

Erolia Vieillot. Sandpipers. Complete tarsometatarsus UKMNH no. 6064 with slight defacement on the lateral edges of the external and internal cotylae. This fossil cannot be identified as to the species. *Erolia melanotos* or *E. alpina* appear to resemble the fossil more closely than do other small

sandpipers. *E. melanotos* differs somewhat in greater size, whereas *E. alpina* has one of the calcaneal ridges smaller than in the fossil.

Calidridiinae, indeterminate. Distal ends of humeri UKMNH nos. 5677 and 5670. The morphology of available features suggests some resemblance to *Crocethia* or *Erolia* but generic affinity is not determinable.

Scolopacidae, indeterminate. Coracoids UKMNH nos. 6058 and 5674; carpometacarpi no. 6063 (proximal), no. 5683E (distal), and distal end of ulna no. 5675. The coracoids show greatest re-

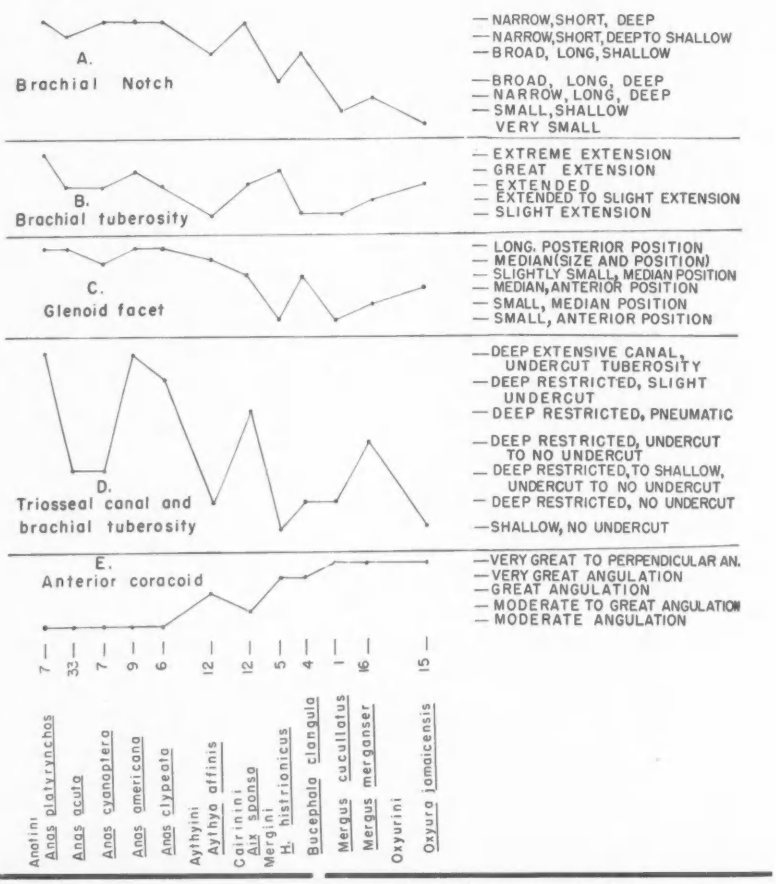

Fig. 2. Comparison of structure of coracoid in Anatidae. Each character listed at left was classified according to categories listed at right. A, shape of brachial notch; B, degree of extension of brachial tuberosity beyond contour of shaft; C, size and position of glenoid facet relative to proximal end in ventral view; D, degree of excavation of triosseal canal area and undercut beneath overhanging lip of brachial tuberosity; E, angle between longitudinal axis of head, or plane of surface of brachial tuberosity, and transverse axis of shaft viewed from anterior end of bone. Numbers of specimens examined are given to the right of scientific names.

semblance to *Limnodromus* and *Bartramia* on the basis of length, contour of shaft, distance across the triosseal canal, and position and shape of the glenoid facet. The proximal end of the fossil carpometacarpus suggests resemblance to *Arenaria, Totanus,* and *Limnodromus,* but the features are not satisfactory for determinations. Likewise, the distal end of the carpometacarpus has few diagnostic characters; however, there is some suggestion of resemblance to *Calidris* or *Bartramia*. The ulna resembles *Tringa solitaria* and *Erolia melanotos* in size and contour of the carpal tuberosity.

FAMILY COLUMBIDAE (fig. 5).

Zenaidura macroura (Linnaeus). Mourning Dove. A proximal end of carpometacarpus UKMNH no. 5650. The fossil is identical to *Zenaidura macroura* in width of the carpal (3.2 mm.), length of the symphysis (6.3 mm.), the scar for the attachment of the flexor digit III being parallel to the anteroposterior plane of the bone. Its size is equal to the corresponding element in *Z. macroura*. The internal flange of the carpal is longer than broad, and the base of the pisiform process is also of similar size.

FAMILY ICTERIDAE (fig. 5).

? *Agelaius* Vieillot. Blackbird. Complete carpometacarpus UKMNH no. 5648. Comparisons were

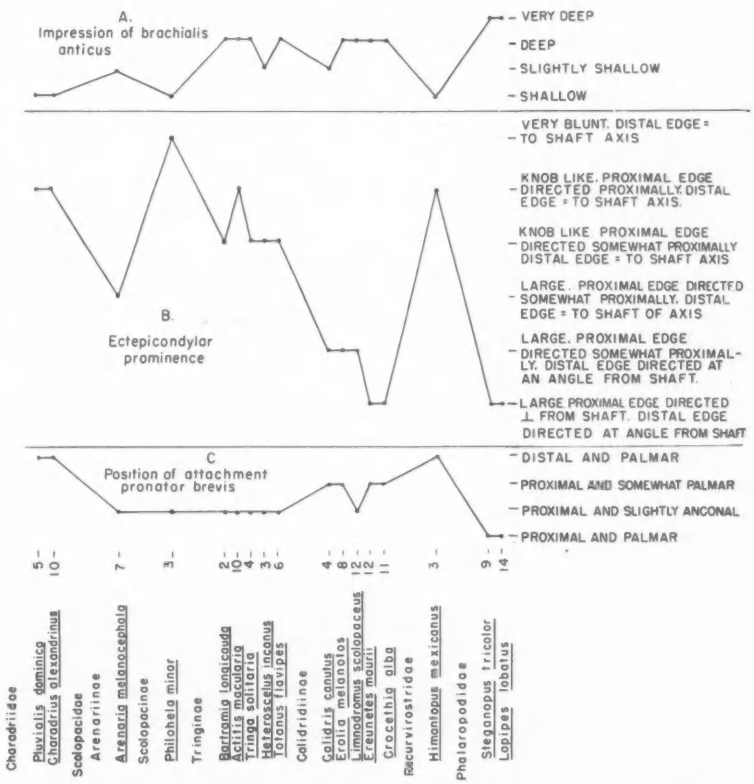

Fig. 3. Comparison of structure of distal humerus in Charadroidea. Data organized as in figure 2 (see legend).

made with *Xanthocephalus, Agelaius* and *Euphagus,* and though all are similar to the fossil, nearest affinity seems to be with *Agelaius.* A definite generic assignment is not possible.

? *Molothrus* Swainson. Cowbird. Incomplete carpometacarpus UKMNH no. 5669 and proximal end of humerus UKMNH no. 6062. The fragmentary carpometacarpus appears to be most closely

Table 4

Comparison of Tarsometatarsus No. 6394 with Samples of Recent Scolopacidae*

Characters	Number of specimens	Mean	Observed range	Standard deviation	Dimensions of fossil specimen	Difference / Stan. dev.	P
Total length							
Bartramia longicauda (skins and skel.)	16	47.78±0.54	44.2–52.5	2.15	46.3	0.7	.....
Totanus flavipes (skins and skel.)	15	52.17±0.43	48.3–54.8	1.65	46.3	3.6	<.0004
Limnodromus scolopaceus	12	41.29±0.84	36.7–44.7	2.43	46.3	2.1	<.04
Micropalama himantopus (skins)	10	41.35±0.75	37.9–44.9	2.36	46.3	2.1	<.04
Distal width							
Bartramia longicauda (skins and skel.)	14	5.82±0.56	5.3–6.2	0.21	5.9	0.3	.....
Totanus flavipes (skins and skel.)	15	4.28±0.76	3.9–5.0	0.30	5.9	5.5	<.00006
Limnodromus scolopaceus	12	4.56±0.48	4.2–4.9	0.16	5.9	8.1	<.00006
Micropalama himantopus (skins)	10	3.63±0.75	3.1–4.0	0.24	5.9	9.6	<.00006

* See footnotes of table 1.

related to *Molothrus ater.* The partial humerus is certainly a small icterid, possibly an immature *Molothrus,* although *Icterus galbula* and *I. bullockii* show certain resemblances also.

Icteridae, indeterminate. Proximal ulna, UKMNH no. 6067.

FAMILY FRINGILLIDAE (fig. 5).

Calamospiza melanocorys Stejneger. Lark Bunting. Incomplete upper mandibles UKMNH nos. 5674 and 5674B. In no. 5674 the posterior half of the internarial bridge, the right maxillary and small portion of the premaxillary and posterior borders of the narial openings are absent. No. 5674B has only the anterior part of the mandible present, but features available for comparison show resemblance to no. 5674.

These fossils show marked resemblance to *C. melanocorys* in the broadly based, fully arched premaxillary. On the posterior vertical surface of the maxillary area of the fossil (no. 5674) there are two foramina, near the vertical margin. These foramina may be observed in recent skulls through the external narial openings. It appears that extensions of the fifth (trigeminal) and seventh (facial) nerves and branches of the maxillaris artery and vein might pass through these foramina; a specimen of *Carpodacus mexicanus frontalis,* MVZ no. 63138, has a transparent mandible and the foramina may be traced as channels with small end branchings at the tip of the mandible. These foramina in *Dolichonyx, Guiraca* and *Carpodacus* tend to be more widely separated from each other than in the fossil and *Calamospiza.* Additional features that resemble *Calamospiza* are the prominent central grooves bordering a narrow well-developed median ridge on the palatal surface, the internarial bridge widened anteriorly and gently arched, and a moderately stout maxillary. This is the first fossil record of this species, which is today a common summer resident in Kansas.

Calcarius Bechstein. Longspur. Incomplete upper mandible, UKMNH no. 6068, the left maxillary, tip of premaxillary and posterior borders of narial openings are absent. *Calcarius* resembles the fossil in the relatively deep and wide central grooves of the palatal surface, the foramina of the maxillary area (*Plectrophenax* has the foramina closer together and they are larger than in the fossil and

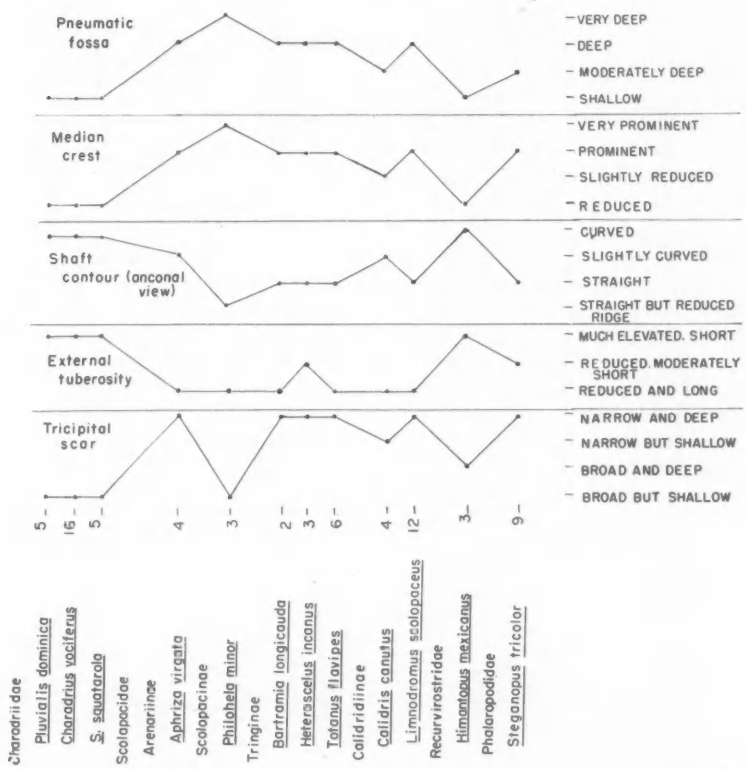

Fig. 4. Comparison of structure of proximal humerus in Charadroidea. Data organized as in figure 2 (see legend).

Calcarius), the slim premaxillary with slightly incurving lateral edges, the widely arched contour of the anterior border of the external naris, the narrow but relatively deep internarial bridge, and a maxillary wide anteriorly with marked narrowing to a point at the posterior tip (the tip is directed ventrally). Specific distinction is not possible although it appears that *C. ornatus* is smaller than the fossil. *C. pictus* (of equal size to the fossil) is reported from eastern Kansas today whereas *C. lapponicus* (also the same size as the fossil) commonly occurs as a winter resident in western Kansas. *C. lapponicus* is, therefore, more likely to be the species represented by the fossil. This is the first occurrence of the genus in the fossil record.

Lambrecht (1933) has shown that there are records of "*Passerina* (*Calcarius, Plectrophanes*) *nivalis,*" the Snow Bunting, in the Pleistocene of Europe. On the basis of nomenclature used in the A.O.U. Check-list (1931), Witherby *et al.* (1939), and the synonymy of Ridgway (1901), it is assumed that the species referred to by Lambrecht is *Plectrophenax nivalis,* not the longspurs of the genus *Calcarius*.

Emberizinae, indeterminate. Complete humerus, UKMNH no. 5656, distal end of humerus no. 5667, proximal end of humerus no. 6059, complete tibiotarsus no. 5683F, distal fragments of tibiotarsi no. 5683E, J, and K, proximal fragment of tibiotarsus no. 5683H, complete ulna no. 5671, incomplete lower mandible no. 6066, complete carpometacarpus no. 6061..

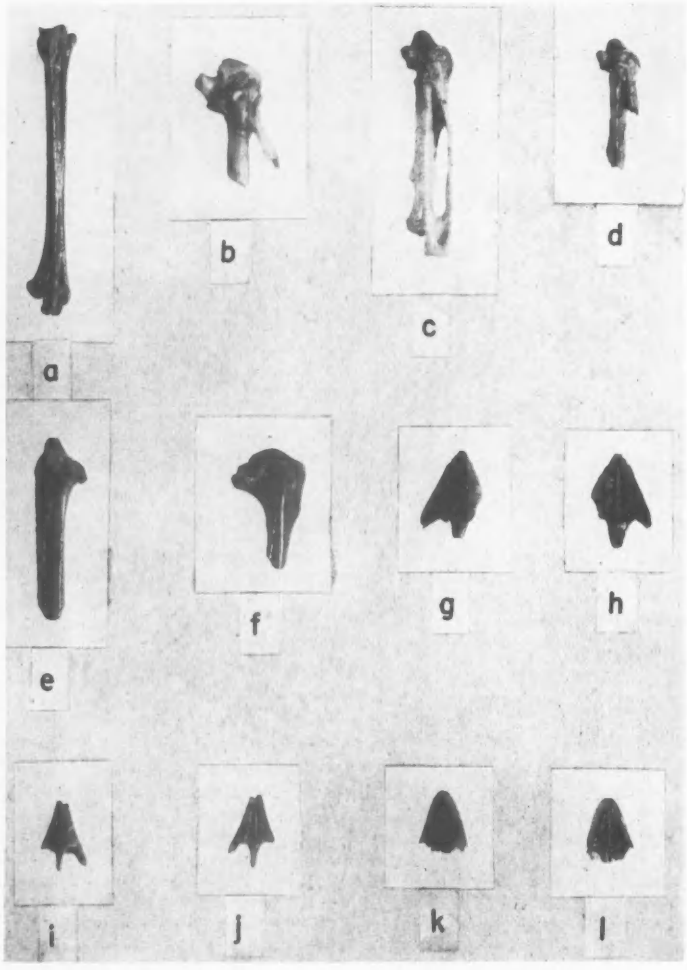

Fig. 5. Bones of Pleistocene birds from the Jones Fauna of Kansas. All photos × 2. *a, Erolia,* tarsometatarsus, UKMNH no. 6064; *b. Zenaidura macroura,* proximal carpometacarpus, UKMNH no. 5650; *c, ? Agelaius,* carpometacarpus, UKMNH no. 5648; *d, ? Molothrus,* proximal carpometacarpus, UKMNH no. 5669; *e,* Icteridae, proximal ulna, UKMNH no. 6067; *f, ? Molothrus,* proximal humerus, UKMNH no. 6062; *g, Calamospiza melanocorys,* dorsal view of upper mandible, UKMNH no. 5674; *h, Calamospiza melanocorys,* ventral view of upper mandible, UKMNH no. 5674; *i, Calcarius,* dorsal view of upper mandible, UKMNH no. 6068; *j, Calcarius,* ventral view of upper mandible, UKMNH no. 6068; *k, Calamospiza melanocorys,* dorsal view of upper mandible, UKMNH no. 5674B; *l, Calamospiza melanocorys,* ventral view of upper mandible, UKMNH no. 5674B.

Fringillidae, indeterminate. Two incomplete coracoids UKMNH nos. 5678 and 6060.

Many of these small specimens of fringillids are indeterminate type of sparrows and buntings which, in their various characters, could represent *Passerculus, Ammodramus, Junco, Aimophila, Spizella, Melospiza, Zonotrichia, Chondestes* or *Pooecetes.*

In addition to the specimens noted above, there are fifteen unidentified elements probably referable to Anseriformes, four to Charadriiformes, five to Passeriformes, and thirty-two miscellaneous bird bones. The total number of fragments or complete elements from the Jones avifauna is 115.

NOTES ON COMPARATIVE OSTEOLOGY

Some general, though tentative conclusions as to the characterization of critical features in elements of Recent ducks and shorebirds that were compared with the fossils are included in chart form in figures 2, 3 and 4. The charts reflect subjective evaluation in most instances and cannot be used as keys to identification of a particular group in a strict sense; they may, however, be of some assistance in segregating isolated bones. Since the study did not include a survey of all species of ducks and shorebirds, the conclusions cannot be interpreted as applicable to all members of the subfamilies listed. The statements apply only to the groups included. Further investigations along these lines may be worthwhile and should be attempted before conclusions of general taxonomic significance can be made.

In the study of the coracoid in ducks an attempt may be made to correlate structure and function. The data interpreted from figure 2 suggest that the habits of surface feeding and quick vertical ascent from the water (see Bent, 1923; Witherby *et al.*, 1939; and Delacour and Mayr, 1945) in species of the tribes Anatini and Cairinini may be correlated with slight angulation of the head, great excavation of the triosseal canal (the teals appear to vary more than the other species of Anatinae in this character), a wide triosseal canal relative to total length of the bone, and the posterior position and large size of the glenoid facet. In contrast the tribes Aythyini, Mergini, and Oxyurini, predominantly diving birds and types tending to patter or paddle along the surface of the water before taking fully to the air, have greater twist of the head regions of the coracoid and relatively narrower triosseal canal. The other characters analyzed show greater variability in these tribes than the tribes Anatini and Cairinini.

The perching ducks of the tribe Cairinini are a distinct group but show affinity with the river ducks or tribe Anatini, according to Delacour and Mayr (1945). The features of the coracoid studied in this report further indicate this relationship.

In the process of analysis of recent species of shorebirds, it became apparent that certain characters show particular trends in the various groups studied. Figures 3 and 4 present some of these trends graphically and require no detailed comment here. *Philohela* shows similarity to the other scolopacids in the feature of the external tuberosity of the proximal end of the humerus, but has possibly distinctive specialization in the development of the pneumatic fossa, the median crest, and the contour of the shaft in this element. Study of the coracoid (not shown in the charts) has revealed a resemblance of species of Charadriinae and Recurvirostridae (including *Himantopus* and *Recurvirostra*) in the presence of the small coracoidal fenestra. Species of the subfamilies Arenariinae, Scolopacinae, Tringinae and the family Phalaropodidae lack this fenestra.

From the viewpoint of taxonomic relationships, it is notable that the features of the distal end of the humerus and the coracoid in species of the subfamily Arenariinae show consistent resemblance to species of the subfamilies Tringinae and Calidridiinae rather than to those of the Charadriidae. This evidence appears to support the placement of the Arenariinae in the family Scolopacidae as Peters (1934:2), Lowe (1931), and Witherby *et al.* (1940) have done rather than in the Charadriidae as shown in the A.O.U. Check-list, 1931.

The families Charadriidae and Recurvirostridae (as represented in this study) consistently show resemblance to each other in all the characters of the humerus and coracoid that were examined. Further examination of skeletal elements should be made to determine the possible significance of this apparent phyletic relationship.

ENVIRONMENTAL RELATIONSHIPS

The area of the Jones fauna locality today is characterized by relatively rough terrain with portions of flat upland, some steep slopes (Frye, 1942) and plains grasslands mixed locally with deciduous trees (Pitelka, 1941; Dice, 1943). A summarization of general ecological associations represented by the types of birds found in the fossil avifauna from this locality is shown in table 5. The local habitats and distribution of recent

Table 5

Environmental Relationships Indicated by Species and Higher Groups from the Jones Avifauna

Species	Recent local habitat and distribution in Kansas	Associations
Colymbus caspicus	Formerly common migrant, now rare. Goss records occasional breeding in colonies. Found on fresh water, marshy shallow lakes, alkali or reedy streams and undisturbed ponds. Diving birds.	Pond or lake
Anas acuta	Common migrant, in large numbers. Found on fresh water, shallows, marshes, ponds in prairie country. Surface feeders.	
Anas (teals)	*A. carolinensis* fairly common migrant; *A. discors* common migrant, occasional summer resident; *A. cyanoptera* rare migrant, formerly possible summer resident. Found on sloughs, shallow pools, lakes, ponds and streams. Surface feeders.	
Anas clypeata	Common migrant, formerly rare summer resident. Found typically on marshy shallows, ponds, lakes. Nests in grassland or sloughs. Rests on open water or lakes. Surface feeders.	
Aythya (? *americana, affinis, collaris* or *marila*)	*A. americana* rare migrant; *A. affinis* common migrant; *A. collaris* occasional migrant; *A. marila* (?). Found on marshy lakes, sometimes shallow to deep and on open ponds or lakes. Usually diving ducks.	
? *Bucephala albeola*	Rare migrant; formerly common. Found on fresh water, alkali lakes and ponds. Diving duck.	
Erolia; other Scolopacidae	Many species are common migrants, occurring in flocks. Found on muddy flats, shores of ponds, lakes; some on uplands, rainpools. Fresh or alkaline water.	
Icteridae: ? *Agelaius* or *Euphagus*; *Molothrus*	Common summer residents. Nest in grassland, meadows, marshes, lakes and reedy areas. Forage on upland fields, prairies and alluvial areas.	Marsh and upland
Bartramia longicauda	Common summer resident, south and western Kansas. Prefers upland prairies or grass plains for food and nests. Seldom near water's edge as are other sandpipers or plovers.	Upland plains
Calamospiza melanocorys	Common summer resident, western Kansas. Abundant, characteristic bird of open plains. Nest on ground in same area. Feed on seeds and insects. Flock after breeding.	
Calcarius (? *lapponicus, pictus* or *ornatus*)	Common winter resident, especially *C. lapponicus* and *C. ornatus* in western Kansas. Found in open treeless prairies and grasslands. Large flocks. Feed on seeds and insects.	
Zenaidura macroura	Abundant summer resident. Found in plains or woodland. Flock. Go to water usually twice daily.	Various

birds listed have been summarized on the basis of reference to Goss (1891), Sclater (1912), Bailey (1928), Long (1940) and Grinnell and Miller (1944). In general it appears that the faunal picture was not different from a similar association of birds and environment today in many parts of the plains region of western Kansas and eastern Colorado. However, the local, relatively dry situation which exists today in the immediate area of the fossil locality indicates that this particular area has undergone significant change. One prominent element of the habitat that must have been present much of the time was a marshy lake area that could support diving and surface feeding ducks. Tall marsh grasses or reeds possibly provided nesting sites for blackbirds and the Eared Grebe.

Hibbard (1940) believes, on the basis of study of mammalian material and the conclusions of Goodrich (1940), that climatic conditions at the time of the existence of the fauna were more humid and cooler than those of today. Evidence presented from analysis of bird material neither supports nor denies the idea of a cooler climate having been present in the area; but it has been shown that some of the bird species do verify the thesis that the immediate area may have been more humid than it is today. Tihen's proposal (1942) that the deposition may have occurred during dry years, in even as little time as two seasons, cannot be supported directly or modified by a study of bird material, for the avian remains could have accumulated during several seasons of varying wet and dry character.

The total number of individuals represented by the fossil record is probably a minimum indication of the original populations. There are at least 19 individuals among the 115 fragments and complete elements. Approximately 37 per cent of these individuals represent ducks, 21 per cent fringillids, 21 per cent shorebirds, 11 per cent icterids, 5 per cent colymbids and 5 per cent columbids. Catastrophic or unusual causes of death are not indicated by the quantity of remains present nor by the probable mode of deposition. Death from age, disease, accidents or predation probably occurred; however, no predatory species of birds have been found.

Geologic relationships, the details of which have been discussed previously, imply that a unique process of deposition of the fossil material may have occurred. Possibly the nature of the history of this sink-hole area would have allowed convergent washing of remains of upland species toward the level of the sink by way of many incising erosional channels. Thus, the chance for a central concentration of bone material could have increased as compared to deposition of similar fossil material in a running stream bed. The lack of an outlet drain in the area would also increase the chances for permanent placement of the remains of the water dwelling types in the bottom of the sink. The time necessary to complete the deposit of the sediments containing the fossils has not been determined; considering the history of recent sink-hole deposition, it seems likely that not many years were needed to accumulate the bones. Knowing the circumstances of the probable method of deposition at that time, it is possible to assume that a fairly complete representation of the variety of birds present in the immediate area of the Jones fauna has been recovered. However, the number of individuals found cannot be considered indicative of any probable population size.

COMPARISON WITH SOME OTHER PLEISTOCENE BIRD FAUNAS

From the viewpoint of quantity of specimens, the Jones avifauna cannot be compared with other larger Pleistocene bird assemblages such as those reported from Florida (Wetmore, 1931), from México in the San Josecito Cavern (Miller, 1943), Fossil Lake, Oregon (reviewed by Howard, 1946), the Carpinteria and McKittrick asphalt in California (DeMay, 1941*a*, 1941*b*), Hawver, Potter Creek and Samwell caves (sum-

marized by Miller and DeMay, 1942), and the large accumulation of bones from the Rancho La Brea (summarized by Miller and DeMay, 1942). Comparisons can be made, however, between these faunas and the Jones fauna with regard to kinds of birds represented. The content of the Jones fauna bird assemblage is distinctly different from any of the above-mentioned faunas because of the presence of the specific upland, plains types of birds—*Bartramia, Calamospiza* and *Calcarius*. The great plains or prairie aspect of the environment of the Jones fauna thus sets it apart from the other Pleistocene assemblages in North America.

GEOLOGIC AGE

The similarity of the identified birds with modern species and genera suggests that the avifauna is probably not older than late Pleistocene. The presence of certain other animals in the fauna such as *Lymnaea* (a snail), *Sorex cinereus* (masked shrew), *Citellus richardsonii* (Richardson ground squirrel) and *Microtus pennsylvanicus* (meadow vole) all suggest inhabitants of areas with a cooler climate. In addition the occurrence of the now extinct genera *Platygonus* (a peccary) and *Camelops* indicate that the fauna, including the birds, is not younger than late Pleistocene age.

SUMMARY

The Jones avifauna of southwestern Kansas is the first to be studied from the Pleistocene of that state. Over a hundred avian fossil elements have been recorded; these represent ten genera of birds, six of which have been identified as to species; six additional forms are indeterminate as to genus within their designated groups.

Bartramia longicauda, Calamospiza melanocorys, and the genus *Calcarius* are reported for the first time as fossils.

Observations made on recent bird skeletons during the process of identification of the fossils have provided some data on relationships in the Anatidae on the basis of the structure of the coracoid, and in the Charadriiformes on the basis of the structure of the coracoid and humerus.

The avian fossils identified suggest that near the Jones locality there was a marshy lake or pond with surrounding upland plains or prairies. The climate may have been more humid than it is today. The content of the avifauna suggests probable late Pleistocene dating, an age further verified in previous studies of the mammals from the same deposit.

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Los Angeles County Museum, Los Angeles, California, February 25, 1954.

An unusually placed nest of the Black Phoebe built on a length of loosely hanging wire. Photographed by Ray Quigley, Jr.

FROM FIELD AND STUDY

Unusual Black Phoebe Nest.—In La Habra Heights, Los Angeles County, California, on March 26, 1941, a search for a nest of the Black Phoebe (*Sayornis nigricans*) under an old wooden bridge proved successful. Several old nests were found plastered onto vertical sides of the bridge. The occupied mud nest, however, was circular and was fastened onto a length of bailing wire dangling from an overhead support, as shown in the accompanying figure.—RAY QUIGLEY, JR., *Whittier, California, February 28, 1953.*

Additional Bird Records for the Cariboo Parklands, British Columbia.—During the field season of 1953, my intensive investigation of the avifauna of the Cariboo Parklands biotic area in British Columbia was continued. Some interesting new distributional records were obtained.

Dendroica magnolia. Magnolia Warbler. This is a characteristic nesting species in the subalpine forest area near Quesnel and Indianpoint Lake, British Columbia, but there have been no records of the species either in the summer or in migration through the Cariboo Parklands. On August 17, 1953, a male was taken 25 miles east of Williams Lake; on August 29, two others were observed in Williams Lake, B. C.; on September 9, 1953, another male was taken at 144-Mile House. These occurrences suggest that in 1953 there was an unusual southward movement that brought the species through the Cariboo.

Dendroica striata. Black-poll Warbler. A male was taken from a flock of three at Williams Lake on September 9, 1953. Three others were seen at Alkali Lake on September 7, 1953. These are the first records out of the subalpine forest area.

Riparia riparia. Bank Swallow. This species is widely distributed in the province but has not previously been taken in the Cariboo Parklands. An immature individual was collected from a mixed flock of swallows at Springhouse on August 29, 1953.

Empidonax difficilis. Western Flycatcher. The usual range of this species is in the humid coastal forest but there are scattered records for the Okanagan Valley and one from the subalpine forest area near Bowron Lake (Dickinson, Bull. Mus. Comp. Zool., 1953:166). A juvenal male, taken at Alkali Lake, British Columbia, on September 9, 1953, is the second record of occurrence in the Cariboo Parklands.—LEO JOBIN, *Williams Lake, British Columbia, February 4, 1954.*

Golden Eagles Attacking Coyote.—About 3:00 p.m., November 21, 1953, while driving through the Colorado Antelope Refuge northeast of Fort Collins, Colorado, I noticed two dark objects on the brow of a hill. Through 7×35 binoculars the objects were seen to be two Golden Eagles perched approximately 30 feet apart on the ground. Just then a coyote stalked out of a stubble field toward one of the eagles. When the coyote was about 20 feet away, both eagles detected him. They launched from the slope and circled in pursuit of the coyote.

While the eagles made short successive stoops, the coyote ran rapidly down the ridge and to the top of the next hill. Confused, he turned downhill into the valley, where he finally eluded the two eagles by diving into a sinkhole which was quite long and narrow, about 4×5×20 feet. The eagles made two or three more stoops over the sinkhole, but couldn't reach the coyote. Thwarted, the eagles returned to their perches on the same knoll and the coyote remained hidden.—NORTON R. MINER, *Fish and Wildlife Service, Fort Collins, Colorado, January 28, 1954.*

Bird Records for Nevada.—On a trip to southern Nevada in October, 1953, I encountered several kinds of birds and some of the observations on them supplement reports on Nevada birds by Linsdale (Pac. Coast Avif. No. 23, 1936; Condor, 53, 1951:228-249).

Aegolius acadicus. Saw-whet Owl. Specimens have been obtained from five localities in the state. On October 10, 1953, I found but did not preserve the remains of one in a tank at Deadman Spring, 6400 feet, on Sheep Mountain, about 50 miles north of Las Vegas.

Ixoreus naevius. Varied Thrush. Reports of this thrush have come to the Fish and Wildlife Service from Claude J. Smith who saw six at Lake Tahoe on March 3, 1939, and from E. C. D. Marriage who saw one at Carson City on January 12, 1948. I saw one on October 10, 1953, at Pine Spring (Hidden Forest), 45 miles north of Las Vegas.

Dendroica townsendi. Townsend Warbler. In the Charleston Mountains on October 7, 1953, I saw two in Kyle Canyon and one at Willow Creek. On October 12 one was at the summit of Charleston Peak. I saw two at Pine Spring in Hidden Forest, Sheep Range, on October 10.—CLARENCE COTTAM, *Fish and Wildlife Service, U. S. Department of the Interior, Washington 25, D.C., December 21, 1953.*

The Ash-throated Flycatcher at Vancouver, British Columbia.—On October 7, 1953, while banding birds at Marpole, Vancouver, British Columbia, I captured an Ash-throated Flycatcher (*Myiarchus cinerascens*). It was an adult male in delayed molt and was taken by means of a net set up in a mixed deciduous growth of maple, alder, and other broad-leaved trees. The area is fairly moist. As far as I can ascertain, this is the first record of this species in Canada. It is now specimen no. 38710 in the Kenneth Racey Collection in Vancouver. On October 11, 1953, I captured at the same place another individual of this same species. This one was banded and released.—WM. M. HUGHES, *Vancouver, British Columbia, February 19, 1954.*

Report on the Two Native Passerines of Nihoa, Hawaii.—On December 21 and 22, 1953, and on March 18, 1954, I had the opportunity, thanks to the United States Coast Guard, to land on rarely visited Nihoa Island, an isolated mile-long islet in the Hawaiian Archipelago located about 300 miles west-northwest of Honolulu. Since the sole two land birds of Nihoa are endemic and have not, apparently, been observed since 1940 (Vanderbilt and deSchauensee, *Notulae Naturae,* Acad. Nat. Sci., Phila., 86, 1941:1-14), notes on the continued existence and feeding and breeding habits of these little known species may be of value. Nomenclature follows Amadon (Bull. Amer. Mus. Nat. Hist., 95, 1950:155-270).

Psittirostra cantans ultima. Laysan Finch. Family Drepaniidae. This bird remains reasonably numerous on Nihoa for we saw 15 to 20 individuals during two to three hours of observation on a limited part of the island in December. We found both sexes in rather bright yellow plumage then, compared to the dull coloration of Vanderbilt's specimens taken in August, 1940, but apparently not yet breeding. Two old nests were found—one, I think the first such nest site known for any drepaniid, in a rocky recess near the base of a cliff. In March in this same cliff nest, distinctive because of a number of large seabird feathers built into it, I found a young Laysan Finch not quite fledged. I believe this is the first breeding information of this drepaniid, although eggs of its related form on Laysan are known from May. Adding to its previously known habit of eating sea bird eggs and other animal and plant foods, I repeatedly observed in December the Laysan Finch eating the small, green flower heads of *Chenopodium sandwicheum* (which forms much of the native plant cover of Nihoa). Also, I observed one bird picking out the still partly green seeds of *Portulaca caumii,* a plant endemic to the island. This "finch" still allows approach to within three or four feet—a testimony to its effective isolation. The related form, *P. c. cantans,* survives on Laysan Island over 600 miles away.

Acrocephalus familiaris kingi. Nihoa Miller Bird. Family Sylviidae. The only relative of this reed warbler in the Hawaiian Archipelago, *A. f. familiaris* from Laysan, has been extinct for over thirty years. Vanderbilt apparently found the Nihoa species fairly common in 1940, and collected nine specimens. We found the bird still present in December, 1953, but saw just two individuals during our limited observation.—FRANK RICHARDSON, *Bernice P. Bishop Museum, Honolulu, Hawaii, April 1, 1954.*

Observations on the Sandhill Crane in Northeastern California.—Recent literature dealing with the Sandhill Crane (*Grus canadensis tabida*) in California has in most cases been restricted to information on migration and wintering grounds. According to Leopold (1951, "Game birds and mammals of California—a laboratory syllabus," Berkeley, California), there have been no records of Sandhill Cranes nesting in California since 1931. However, it is the opinion of the writers that Sandhill Cranes have nested in scattered locations throughout northeastern California each year but observations have not been recorded and published. It is the objective of this paper to record spring and summer observations on Sandhill Cranes in northeastern California for the years 1948 through 1953.

Every spring since 1948, a waterfowl breeding ground survey has been carried on in California. The survey consists of making counts of breeding pairs of waterfowl on all major production areas within the state. The breeding ground survey in northeastern California in 1948 consisted only of ground counts but in 1949 the ground surveys were supplemented by aerial coverage. Since 1950, the

method of survey has consisted mainly of aerial coverages carried out during the last week of May and the first week in June. Each year the number and status of cranes was recorded as supplementary information to the number of breeding waterfowl. The cranes were recorded as pairs when seen together. Single cranes were recorded when only one bird was present at a nest site or in a particular

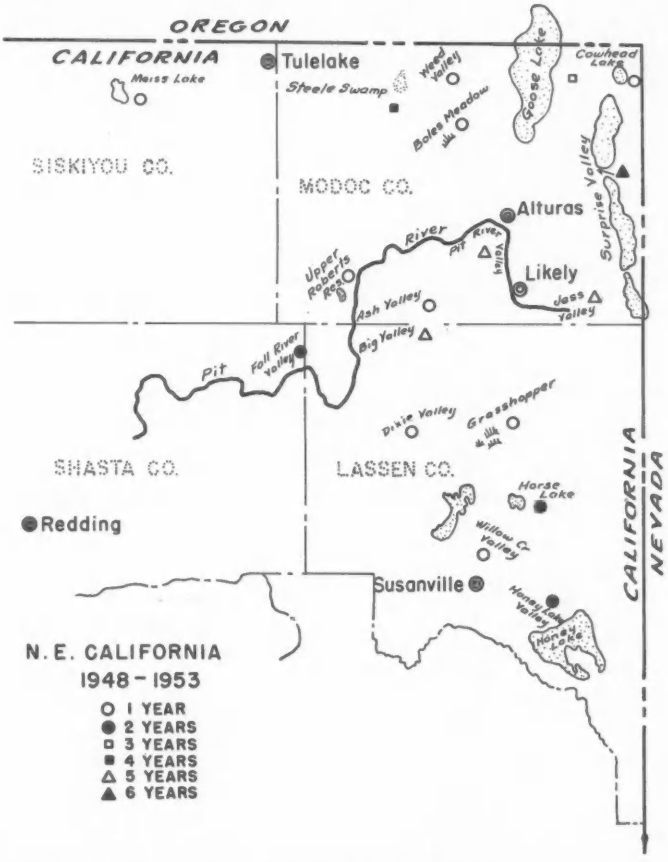

Fig. 1. Map showing localities from which Sandhill Cranes are reported.

area. Young birds of the year were recorded when seen and are so designated in the following tables. Three or more cranes seen together constituted a group. The nests recorded were observed from the air and no ground checks of the nests were made to determine the fate of nests. The number of cranes and nests in any of the categories in the following tables may or may not represent the total number in any particular area. A map of the areas covered in this paper is shown in figure 1. Summaries of observations on each area are given in tables 1 and 2.

In all of these areas cranes were found in remote localities where wet meadows existed and human interference was at a minimum. Table 2 indicates a reasonably stable population in northeastern California with fluctuations during extreme conditions of weather and water abundance. It is believed

Table 1

Localities Surveyed and Total Number of Cranes Found in Successive Years

	1948	1949	1950	1951	1952	1953
Big Valley, Lassen Co.	6*	9	0	2	14*	9*
Fall River Valley, Shasta Co.	0	0	0	2	2	0
Goose Lake, Modoc Co.	7	0	0	2	4*	0
Honey Lake Valley, Lassen Co.	0	0	0	0	2*	4*
Horse Lake, Lassen Co.	0	0	Not surveyed	Not surveyed	2	2*
Jess Valley, Modoc Co.	5	9	0	13*	29*	22*
Pit River Valley, Modoc Co.	9*	8	0	10*	14*	15*
Steele Swamp, Modoc Co.	2	4*	0	2	4*	0
Surprise Valley, Modoc Co.	22*	20*	24*	2	22*	6
Boles Meadow, Modoc Co.	0	0	0	2	0	0
Willow Creek Valley, Lassen Co.	0	0	0	2	0	0
Upper Roberts Reservoir, Modoc Co.	0	0	0	0	2*	0
Grasshopper Valley, Lassen Co.	0	0	0	0	2	0
Cowhead Lake, Modoc Co.	Not surveyed	Not surveyed	Not surveyed	Not surveyed	3*	Not surveyed
Weed Valley, Modoc Co.	Not surveyed	Not surveyed	Not surveyed	0	4	0
Meiss Lake, Siskiyou Co.	Not surveyed	Not surveyed	Not surveyed	0	3*	0
Ash Valley, Modoc Co.	Not surveyed	Not surveyed	Not surveyed	Not surveyed	Not surveyed	2
Dixie Valley, Lassen Co.	Not surveyed	Not surveyed	Not surveyed	0	0	2*
Totals	51	50	24	37	107	62

* Nests found or young observed; latter included in estimate of total cranes present.

that through the dry years the population may shift to wetter areas in northeastern California or move on north to more suitable nesting habitat. During the dry period prior to 1951, areas such as Honey Lake, Grasshopper Valley, and Horse Lake had such limited rainfall and run-off that little surface water existed and as a result cranes were absent in the nesting season. Since 1951 northeastern California has experienced a wet cycle and virtually all areas have had surface water at some time in each year resulting in new marsh and meadow growth which furnished nesting habitat. With the advent of another dry period the areas may revert back to dried flats with little vegetation, resulting in another shift of the crane population.

Table 2

Summary of Yearly Observations on the Sandhill Crane in Northeastern California

	1948	1949	1950	1951	1952	1953
Pairs	12	17	9	14	39	16
Singles	....	....	....	4	3	10
Groups	22	16	3	....	10	18
Young	5	....	3	5	16	2
Nests	4	3	....	....	5	5
Total cranes	51	50	24	37	107	62

The large number of cranes recorded in 1952 (107) may have been due to the generally wet season and a late cold spring retarding the nesting season about two weeks. This may have resulted in more cranes staying in California that normally would have gone further north. The opposite may have

occurred in 1953 when a warm early spring caused early northward migrations of most waterfowl. Some of the cranes that normally nest in California may have wandered further north before the nesting season began. This may account for the decrease in population in 1953 even though water conditions were ideal in California.—A. E. NAYLOR, A. W. MILLER, and M. E. FOSTER, *California Department of Fish and Game, Sacramento, California, March 2, 1954.*

Sandhill Cranes at Meiss Lake, Northern California.—The fact that around 1500 Sandhill Cranes (*Grus canadensis*) during their spring and fall migratory flights make a stop of three or four weeks at Meiss Lake, Siskiyou County, California, seems to be unrecorded in ornithological literature. According to older farmers in that region the cranes have been stopping there for as far back as they can remember. Members of the Fish and Wildlife Service, with headquarters at Tule Lake, Siskiyou County, were not aware of the occurrence, nor does Walkinshaw mention the Meiss Lake locality in his book, "The Sandhill Cranes" (1949).

While a few Sandhill Cranes of the large form nest at Meiss Lake, the migratory birds stopping there are all the smaller form known as the "Little Brown Crane." Around the last of February or early in March the Little Brown Cranes arrive, first a vanguard of a few, then, a week or so later, in full number. Meiss Lake is just south of the Oregon-California state line. The birds feed and rest at the lake for all of March and sometimes well into April; around the fifteenth of October they are back again to feed and rest a few weeks before continuing south. Farmers report that they are becoming more and more wary each year with the increase in farming, travel and hunting in that area.

Except for the Malheur Bird Refuge in the extreme southeastern corner of Oregon, from where it is reported both Greater Sandhill Cranes and Little Brown Cranes stop during migratory flights, we have been unable to find any record of the Little Brown Cranes stopping anywhere in Oregon or Washington. The thought occurred to me that the Meiss Lake birds might be from the Malheur Bird Reserve—that possibly they might cross southwestward to Meiss Lake instead of flying directly to their winter feeding grounds in California and farther south in the fall and vice versa in the spring. In the fall of 1951, the cranes did not arrive until the first of November. It seemed a good time to inquire whether there had been any observation and banding of cranes at Malheur Reserve. This would be a basis for examining the movement postulated above. Mr. R. C. Erickson, Biologist, replied in part as follows: "Your remarks regarding the possibility of a movement of cranes from Malheur Refuge to the Meiss Lake locality are worthy of consideration for several reasons. In the first place the number (1500) coincides well with the number which occupy the grainfields of Malheur Refuge each fall, though this number also includes a proportion of Sandhill Cranes as well as Little Brown Cranes. Secondly, the build-up of numbers is rather gradual in summer in July, August, and September to a peak early in October, the main exodus occurring ordinarily during the second week of the month. This would coincide with your customary mid-October arrival date at Meiss Lake. Thirdly, the departure of the cranes from the refuge, too, was delayed about two weeks this fall, perhaps on account of the relatively warm autumn with few sustained periods of low temperature during October, and most of them left the refuge the last week of October. As mentioned in your letter, a reliable method of checking the correctness of the assumption that cranes may fly from Malheur Refuge to Meiss Lake would be the study of returns on banded birds. We have no records on that subject."

The older farmers of the region ruefully tolerate the small damage the birds do to their crops in the spring, but the newer farmers, considering the present high price of grain, are not so tolerant. Cranes damage young, sprouting grain, but do most damage on young alfalfa and clover by pulling up young plants in the fields where crops are just starting. In older, established fields where plants are firmly rooted, the damage appears to be slight. Suspicion that resident farmers do shoot at the cranes prompted the Fish and Wildlife Service to provide the farmers with flare guns in the spring to chase the birds from freshly planted fields. Crop damage by ducks, geese and cranes appears to be a mounting complaint among the ranchers, and it is becoming an increasing problem as more land is placed under cultivation.—EDITH RUTENIC MCLEOD, *Klamath Falls, Oregon, January 10, 1954.*

Turkey Vulture Wintering in Northern California.—Although the Turkey Vulture (*Cathartes aura*) is a common summer resident in the interior mountains of extreme northern

California, the writer has not found records for this species in winter. Therefore, it was a surprise to find a single vulture in the Hoopa Valley Reservation, in eastern Humboldt County, during the winter storm season. This bird was first observed feeding on a dead horse alongside a road on December 19, 1953, during a mild snow storm. From that date until a severe storm on January 4, 1954, this individual bird could be observed each day. The bird fed on the gravel bars and perched in dead cottonwood snags along the Trinity River. After the storm of January 4, 1954, the bird was no longer noted.

On February 12, 1954, a single vulture was observed perched on a fir snag on the Klamath River in eastern Humboldt County, about fifteen miles north and east of the Hoopa Valley station. A local resident informed the writer that the bird had first been noted sometime around the first week in January. The local man was quite interested in the vulture as he had never observed them along the Klamath in winter before. It is highly probable that this bird was the same vulture that had been noted at Hoopa, as the dates are almost identical for departure and arrival at the new station. The distance is slight for such a bird. No indication of sickness or injury was noted.—ROBERT R. TALMADGE, *Willow Creek, California, February 27, 1954.*

Western Gull, with Symmetrical Wing Patches, Resembling Aberrant Heermann Gulls.—While and since making observations on the persistence of a rare color aberration in the Heermann Gull (*Larus heermanni*), I have seen, in the general vicinity of San Diego, California, a considerable number of Western Gulls (*Larus occidentalis*) that showed a more or less definite white blotch at the angle along the front of each wing. Usually these symmetrically paired markings were small and irregular and I never could feel quite certain that the peculiarity was not due to displacement of wing coverts or to molting rather than to an aberration in pattern. On December 11, 1953, however, while on a cruise of the M. V. "Horizon," about four miles off the Whistling Buoy near the entrance to San

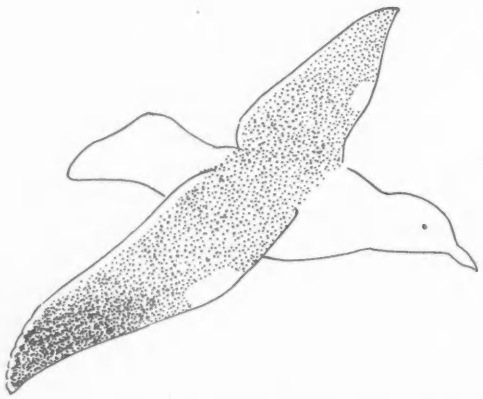

Fig. 1. An adult Western Gull sketched to show position of symmetrical white patches on angles of the wings.

Diego Harbor, I observed for some time at close range (to within 50 feet), with binoculars, from above as well as from the side, a fully adult Western Gull that was unquestionably aberrant in this respect. The approximate size and position of the very definite white areas was indicated on a field sketch, a copy of which is reproduced as figure 1. The aberration is noteworthy not only for its symmetry but also for its resemblance to the color variant noted in the Heermann Gull by several authors (Hubbs and Bartholomew, Condor, 53, 1951:221-227, with references; Pursill and Williams, Condor, 54, 1952:114-115).—CARL L. HUBBS, *Scripps Institution of Oceanography, University of California, La Jolla, California, January 1, 1954.*

Western Grebe in Oklahoma.—The Western Grebe (*Aechmophorus occidentalis*) may migrate regularly through Oklahoma, but it can hardly do so in great numbers for records of any sort are so few. Margaret M. Nice, in the revised edition of her "The Birds of Oklahoma" (1931), does not even mention the species. Orrin W. Letson of Tulsa, Oklahoma, informs me that a Western Grebe was seen repeatedly on Recreation Lake, in Mohawk Park, Tulsa, Tulsa County, by several members of the Tulsa Audubon Society on October 30, October 31, and November 1, 1951, and this observation was reported briefly by Baumgartner (Audubon Field-notes, 6, 1952:25).

On January 3, 1954, along the shore of this same lake, Anne (Mrs. Bruce) Reynolds, one of the persons who had observed the species there in 1951, found a Western Grebe dead. The specimen, frozen solid, reached me in excellent condition a day or so later. I skinned it promptly, finding it to be not at all fat (weight, 857 grams). Its stomach was packed with grebe feathers, presumably its own. It was a female, probably an adult. In the neck I found a small shot-wound—hardly severe enough, I should think, to have caused death directly. The specimen, apparently the first for Oklahoma, is now in the bird collection of the University of Oklahoma.—GEORGE MIKSCH SUTTON, *Department of Zoology, University of Oklahoma, Norman, Oklahoma, January 26, 1954.*

The Generic Name of the Rice Grackle.—One of the most complicated nomenclatorial tangles in ornithology, involving birds of four genera and two families, was skillfully untangled by the late James L. Peters (Proc. Biol. Soc. Wash., 42, 1929:121-123). One of Peters' conclusions was that the Rice Grackle of South and Central America, to which *Cassidix* Lesson had long been misapplied, needed a new generic name. This he supplied, in *Psomocolax*. Although disliking to contravene the opinion of so distinguished a student of nomenclature as Mr. Peters, I believe that the new generic name was not necessary, as I will try to show.

As mentioned by Peters, Ridgway (Birds N. and M. Amer., pt. 2, 1902:196) cited *Scaphidura* Swainson (Classific. Birds, 2, 1837:272) in the synonymy of "*Cassidix*" (*Psomocolax* Peters). Peters came to the conclusion that *Scaphidura* was "a lapsus or emendation of *Scaphidurus* Swainson (Philos. Mag., N.S. 1, no. 6, June, 1827)." The latter name was clearly stated by Swainson to be a substitute for *Quiscalus* Vieillot, on the grounds that Vieillot's name was preoccupied in botany. As correctly indicated by Peters, *Scaphidurus* thus takes the same type and is a pure synonym of *Quiscalus*. The only species listed under *Scaphidurus* by Swainson in this paper (a list of Mexican birds) was *palustris*. Hellmayr (Cat. Birds Amer., 10, 1937:93) applied the latter name to the Slender-billed Grackle of the marshes around Mexico City, showing rather conclusively that *palustris* was the same bird later named *Quiscalus tenuirostris* by Swainson (Anim. in Menag., 1837:299). Swainson himself apparently realized that *palustris* and *tenuirostris* applied to the same species, since only the latter name appears in his "Natural History and Classification of Birds," 1837 (here listed under the genus *Quiscalus*). This work contains the first appearance of the name *Scaphidura*, under which are listed two species, *barita* and *crassirostra*, both, as shown by Hellmayr, synonyms of *Oriolus oryzivorus* Gmelin (Syst. Nat., 1, (1), 1788:386). Hellmayr (*op. cit.*, p. 46, line 36) inadvertently attributed this name to Linnaeus, but gave the correct citation in the synonymy of the species on the next page.

Thus we see that Swainson used *Scaphidura* quite deliberately (since he called the subfamily Scaphidurinae) for a bird which he knew to differ generically from the Slender-billed Grackle which he had placed in his earlier genus *Scaphidurus* and later (granting that he had realized the identity of *palustris* with *tenuirostris*, which the evidence seems to show) placed in *Quiscalus*.

It appears obvious to me that *Scaphidura* cannot be considerd a "lapsus or emendation of *Scaphidurus*," but must stand as a separate name. This is exactly the position taken by Hellmayr, who placed *Scaphidura* in the synonymy of *Psomocolax* rather than *Quiscalus*. Hellmayr, however, rejected as homonyms those generic names differing from earlier names only in gender, as in this case. This rejection is contraindicated by the International Rules of Zoological Nomenclature, and *Scaphidura* Swainson is thus valid and available, with *Psomocolax* Peters as a synonym. The Rice Grackle thus becomes *Scaphidura oryzivora* (Gmelin). There need be no further cause for confusion, since *Scaphidurus* is safely buried in the synonymy of *Quiscalus*.—KENNETH C. PARKES, *Carnegie Museum, Pittsburgh, Pennsylvania, October 6, 1953.*

Westward Extension of the Ranges of the Inca Dove and Bronzed Cowbird.—The regular occurrence of the Inca Dove (*Scardafella inca*) westward to Yuma and Parker, Arizona, has been noted (Monson, Condor, 46, 1944:21; *ibid.*, 51, 1949:264). It was not surprising to the writer, then, to observe four Inca Doves in the Government camp at Parker Dam on the California side of

the Colorado River about 15 miles above Parker on November 15, 1948. Three were subsequently seen at the same place December 7, 1948, very likely of the original four. I believe this is the first authentic instance of the Inca Dove ranging naturally into California. However, I have not seen the species in California since then.

Until 1950, the Bronzed Cowbird (*Tangavius aeneus*) had not been recorded west of the area of Wickenburg, Arizona. A male was seen on the Colorado River Indian Reservation a few miles below Parker, Arizona, on July 30, 1950 (Audubon Field Notes, 4, 1950:289); another male was observed at Whipple Point, on the California side of Havasu Lake, Havasu Lake National Wildlife Refuge, about 12 miles above Parker Dam, May 29, 1951, the first record for California (Audubon Field Notes, 5, 1951:271); a third male was seen near Parker, April 14, 1952 (Audubon Field Notes, 6, 1952:262), and a female was found near Parker, July 1, 1952 (Audubon Field Notes, 6, 1952:294). During the present summer (1953), the species has been observed near Parker from June 27 to July 27. A male and two females were seen July 5, when the male bird was collected.—GALE MONSON, *Fish and Wildlife Service, Parker, Arizona, October 1, 1953.*

A Sparrow Hawk's Roosting Schedule.—One may go about his daily routine in a busy city with only an occasional pleasant diversion by a bird visitor. Sometimes such visit is oft-repeated before it is realized that a pattern of behavior is emerging and that you have failed to catch its beginning. So it was with my Sparrow Hawk in western Los Angeles, California, in the fall and early winter of 1932.

Table 1

Roosting Schedule of a Sparrow Hawk in Relation to Sunset

Date	Arrival time	Sunset	Time interval	Weather condition
Jan. 6	5:11	4:59	12 min.	Clear
7	5:15	5:00	15 "	"
8	5:15½	5:01	14½ "	"
9	5:19½	5:02	17½ "	"
11	5:17	5:04	13 "	"
12	5:17	5:05	12 "	"
13	5:26	5:06	20 "	"
14	5:21	5:07	14 "	"
28	5:40	5:19	21 "	"
29	5:32	5:20	12 "	Rain all day
30	5:28	5:21	7 "	Clear
31	5:31	5:23	8 "	"
Feb. 2	5:29	5:25	4 "	"
3	5:36	5:26	10 "	"
4	5:32	5:26	6 "	"
5	5:41	5:27	14 "	"
6	5:40	5:28	12 "	"
7	5:42	5:29	13 "	"
8	5:38	.....	....	....
9	5:45	5:30	15 "	"
10	5:43	.....	....	Overcast
12	5:45	5:34	11 "	Clear
15	5:54	5:36	18 "	"
16	5:49	5:37	12 "	"
17	5:51	5:38	13 "	"
20	5:56	5:41	15 "	"

From time to time I had noticed a bird in the deepening twilight fly up against the sky and disappear at the roof's edge of my house. Darkness prevented exact identification but it was presumed to be a Poor-will drifted down from the hills—such drift occasionally occurs. As the days grew shorter

the bird came earlier until I realized that it now came before my own supper hour instead of after it. Only at mid-winter did I become aware of a behavioral pattern and begin a record of its movements. With the aid of an electric torch it was discovered that the bird did not fly over the house but went to roost up under the wide eaves on a cross beam and that it was a female Sparrow Hawk (*Falco sparverius*) on its postbreeding grounds.

From then on, as nearly as my own schedule would permit, daily observations were made, noting the time of the bird's arrival and checking it against the daily published record of the sun's movement. From January 6 to February 20, 1933, twenty-six arrivals were noted (see table 1). The average number of minutes between arrival and sunset was 12.7. The minimum was 4 and the maximum was 21. On the one overcast day it was 19 minutes and on the one rainy day, the hawk sat out on a light-pole for 12 minutes in a steady rain until time to go to bed under the protecting eaves.

I learned that the bird had a regular air-way of approach. From the southeast it flew across a depression and up to a light-pole northeast of the house—always the same pole and always the same path through the air. There it would sit motionless until it flew directly to its roosting place. This practically unvaried pattern made my timing record much easier and more accurate. On two mornings the times of departure were recorded. They were 17 and 15 minutes before sunrise—only a little greater than the average evening period of lag.

Here was an individual with a remarkably regular schedule that seemingly was unaffected by overcast skies and which rarely varied notably from the average to produce the two extremes of the record. The cause of these variations is still an unsolved question. Was the regular delay period on overcast or even rainy days the result of a habit induced originally by sensitivity to light? What caused the very short periods of only 4 and 6 minutes? These were on closely approximated days in the record. Was there perhaps a physiological factor at work?

On February 21 the hawk departed and was not seen again.—Loye Miller, *Museum of Vertebrate Zoology, University of California, Berkeley, California, January 10, 1954.*

Two Species of Fish Brought to Nestling Pigeon Guillemots.—Storer (Univ. Calif. Publ. Zool., 52, 1952:139) mentions fish, species undetermined, as food items brought to young, by the Pigeon Guillemot (*Cepphus grylle*) in California. His observations on California guillemots were conducted at the Point Lobos Reserve, Monterey County, California. He watched nests which were on an island across a narrow strip of water and inaccessible.

During the nesting season of 1953 I was fortunate in being able to visit with ease a nest on the mainland. Almost daily observations were made on this nest in July. On four of these visits fish which had been brought to the nest but which had not been eaten by the young were collected. I assume that the young swallow their food fish whole and that these were too large for them to use. The collected fish were taken to the Hopkins Marine Station where Dr. Rolf Bolin identified them and made the following measurements: One Pacific sanddab (*Citharichthys sordidus*), length 106 mm., three rockfish (*Sebastodes jordani*), lengths, 135, 121 and 132 mm. It may be interesting to note that these are bottom-inhabiting fish, thus indicating somewhat the depth to which the guillemot goes in order to obtain food in this area.—Ken Legg, *Natural Bridges State Park, Santa Cruz, California, October 31, 1953.*

Correction of Data Reported on Atlapetes Brunnei-nucha.—In my recent paper revising the Neotropical finch *Atlapetes brunnei-nucha* (Condor, 56, 1954:129-138), under the account of *A. b. brunnei-nucha,* one entire line was replaced in late proof corrections by another belonging elsewhere. Under "Specimens examined," page 132, line 9, read now as follows: México. Hidalgo: El Barrio. San Luis Potosí: Cerro Conejo, Cerro [then continuing next line] San Antonio, Tamazunchale, etc.—Kenneth C. Parkes, *Carnegie Museum, Pittsburgh, Pennsylvania, June 21, 1954.*

NOTES AND NEWS

In conjunction with the AAAS meetings to be held in Berkeley, California, from December 26 to 31, 1954, the Cooper Ornithological Society will sponsor a session for the presentation of scientific papers. Those interested in contributing and wishing to apply for time on the program should write to the chairman of the committee in charge of planning, Dr. Robert T. Orr, California Academy of Sciences, Golden Gate Park, San Francisco, California.

At the summer meetings of the Western Division of the AAAS, a program of papers on birds and mammals was co-sponsored by the Pacific Northwest Bird and Mammal Society and the Cooper Ornithological Society. The meeting occurred on June 22, 1954, at the State College of Washington, Pullman, Washington. Papers dealing with birds were presented by George E. Hudson, Donald S. Farner, and Robert C. Miller.

A geographic tally of the membership list published in this issue shows that the Cooper Ornithological Society is represented in all states and territories of the United States and in 34 foreign countries. The percentage distribution of the 1502 members listed is as follows: California, 44.8 per cent; states east of the Mississippi, 26.8 per cent; other states west of the Mississippi together with Alaska and Hawaii, 20.6 per cent; Canada, 3.4 per cent; European countries, 1.7 per cent; Latin American countries, Africa, India, China, Japan, Australia, and New Zealand, 2.7 per cent.

Changes of address should be sent to Mr. Jack C. von Bloeker, Jr., the Society's Advertising and Circulation Manager.

We report with regret the death on June 11, 1954, of Harry Harris, a member of the Cooper Ornithological Society since 1911 and elected to Honorary Membership in 1950. He will be remembered particularly for his monographic paper on the California Condor in which information on this species available to 1900 was reviewed and for his biography of Robert Ridgway. These papers appeared in the Condor, in 1941 and 1928, respectively. Earlier, Harris studied birds near Kansas City, Missouri, and his "Birds of the Kansas City Region" was published in 1919 by the Academy of Science of St. Louis.

COOPER SOCIETY MEETINGS

ANNUAL MEETING

The Twenty-fourth Annual Meeting of the Cooper Ornithological Society was held at the University of Arizona, Tucson, Arizona, April 22–24, 1954. The meetings were opened by addresses of welcome from local civic and university officers and by a response from J. R. Pemberton, President of the Board of Directors.

The following scientific papers were presented on April 22nd:

Variations in Bird Populations in the Lower Colorado Valley, by Gale Monson (read by A. R. Phillips); Ecology of the Birds of Utah, a Summary, by A. M. Woodbury; Winter Birdlife of the Black Mesa Country of Oklahoma, by G. M. Sutton; Defense versus Exclusiveness in the Definition of Territory, by F. A. Pitelka; The Birds of the Sierra del Carmen, Coahuila, by A. H. Miller; The Birds of Guadalupe Island, Baja California, by T. R. Howell and Tom Cade; Interspecific Competition in Owls of the Genus *Otus*, by J. T. Marshall, Jr.; Safety in Numbers, by John Davis; Warbler Migration in the Southwest, a symposium with J. T. Marshall, Jr., A. H. Miller, and A. R. Phillips as participants.

On Thursday evening, motion pictures entitled "Wings over the Mangroves" and "Phantom of the Marshes" were shown by Bayard W. Read.

The following scientific papers were presented on April 23rd: Pleistocene Birds from the Mohave Desert Region of California, by Hildegarde Howard; Daily Observations of the Intimate Happenings as an Anna Hummingbird Raises Her Family, by Junea W. Kelly; The Relation of Breeding Biology to Climate in Song Sparrows of the Pacific Coast, by R. F. Johnston; Observations on the Hoary Redpoll at Umiat, Alaska, by P. H. Baldwin; The Breeding Season in Relation to Insect Abundance at Point Barrow, Alaska, by F. A. Pitelka; The Biology of Some *Aimophila* Sparrows, by A. R. Phillips; Remarks and Observations on the Water Fowl (Anatidae), by Jean Delacour; Will Another Anatid Establish Itself in Southeastern Arizona?, by L. L. Hargrave; Birds, Beasts and the Rainbow, a motion picture presented by E. R. Kalmbach; A Boat Trip through the Grand Canyon, a motion picture presented by Tad Nichols.

On Friday evening, J. R. Pemberton presided as master of ceremonies at the annual banquet. The evening was concluded with a motion pic-

ture, "African Safari," presented by Ed N. Harrison and Frances Roberts.

On Saturday, field trips were conducted to the Santa Rita and Santa Catalina mountain ranges near Tucson.

An exhibit of bird paintings and photographs was held on the University of Arizona campus during the meeting. Contributing artists and photographers were Jacob Bates Abbott, Don Bleitz, James B. Dixon, Ralph E. Dixon, Don Eckelberry, James M. Gates, Erle D. Morton, Eliot Porter, Ray Quigley, George M. Sutton, Dale T. Wood, and Dora Wright.

This annual meeting was sponsored by the University of Arizona, Tucson Natural History Sosiety, and Tucson Audubon Society, under the leadership of a local committee of which Dr. Allan R. Phillips was chairman.

ANNUAL BUSINESS MEETING

The first session of the annual business meeting of the members of the Cooper Ornithological Society (a corporation) was called to order by President J. R. Pemberton in the Liberal Arts Building, University of Arizona, Tucson, Arizona, at 10:15 a.m., Thursday, April 22, 1954.

The minutes of the meeting of 1953 were read and approved. The following committees were appointed:

Committee to Examine Proxies: John Davis, William R. Fish, and Earle R. Greene; Committee on Nominations: Junea W. Kelly, Frances F. Roberts, and Anders H. Anderson.

The following proposals for membership were read: Russell R. Hoffman, Box 825–A, Kodiak, Alaska, by C. V. Duff; Nicholas V. Karstens, 460 Palmer Road, Las Cruces, N. M., by Edmund C. Jaeger; William R. Hawkins, 1928 N. Burkett Road, El Monte, Calif., and Mrs. Irene Neeper, 6908 Hazeltine Ave., Van Nuys, Calif., both by Jack C. von Bloeker, Jr.

The meeting was then adjourned until April 23.

The second session of the annual business meeting was called to order by President J. R. Pemberton at the same place at 10:20 a.m., Friday, April 23, 1954. John Davis, chairman of the proxy committee, reported 62 members present in person and proxies for 786, of a total membership of 1510. A quorum was declared present. Mrs. Junea W. Kelly, reporting for the Nominating Committee, presented the following names for nomination to the Board of Directors: John Davis, C. V. Duff, Ed N. Harrison, Thomas R. Howell, Alden H. Miller, J. R. Pemberton, Frank A. Pitelka, William J. Sheffler, and Jack C. von Bloeker, Jr. Mr. Pemberton called for further nominations from the floor. There were none. Sherwin F. Wood moved that the nominations be closed and that a unanimous ballot be cast in favor of the election of the entire slate of the nominated directors. The motion was seconded by Allan R. Phillips and unanimously passed.

Mr. C. V. Duff, Business Manager, presented a report on the financial condition of the Society. Membership in the Society is at an all time high. Investment of funds under the supervision of the Investment Committee has resulted in a significant increase in the Society's funds. [An annual financial statement appears on pages 171-172 of the May-June issue.]

Dr. Alden H. Miller presented a resolution on behalf of the members of the Society thanking the local committee, the University of Arizona, and certain non-members, for their efforts in planning and arranging for the Twenty-fourth Annual Meeting. Dr. Miller moved that this resolution be adopted by the Society. The motion was seconded by Ed N. Harrison and unanimously passed.

Dr. Allan R. Phillips presented a resolution that the Cooper Ornithological Society go on record as approving recent efforts made to save the Everglades Kite in Florida, with special recognition of the work of the Florida Game and Freshwater Fish Commission in this regard. Dr. Phillips moved that the Society adopt this resolution. The motion was seconded by Alden H. Miller and unanimously passed. Adjourned at 10:40 a.m.—JOHN DAVIS, *Secretary*.

NORTHERN DIVISION

FEBRUARY.—The monthly meeting of the Northern Division was held on February 4, 1954, at the University of California, Berkeley. Miss Lillian M. Stockwell, 1114 Bay Street, Alameda, California, was proposed for membership by Junea W. Kelly.

President Reynolds passed among the members a letter written by Senator Dawson to the House of Representatives setting forth certain arguments for the construction of a dam in the Dinosaur National Monument. Dr. Reynolds told members that it was not too late to write to the President of the United States or to their congressmen opposing the construction of this proposed dam.

A report was given of a Black-headed Gull seen at the Richmond Yacht Harbor on January 23, 24, and 26 by Jack Guggolz, A. Laurence Curl, Howard Cogswell, and Alexander Sprunt, IV.

Mr. Robert I. Bowman of the Museum of Vertebrate Zoology presented a showing of his motion picture on the natural history of the Galápagos Islands entitled "Indefatigable Island."—ROBERT K. SELANDER, *Secretary*.

MARCH.—The monthly meeting of the Northern Division was held on March 4, 1954, at the University of California, Berkeley. The following names were proposed for membership: Olaf Charles Wallmo, Box 791, Alpine, Texas, by Alden H. Miller; Richard W. Russell, Museum of Vertebrate Zoology, Berkeley, by Robert W. Storer.

A written communication from the Secretary of the Southern Division, concerning elimination of common names for subspecies in the A.O.U. Check-list was read. Howard Cogswell moved that the Northern Division instruct the Secretary to draw up a motion similar to the one in which the Southern Division favored elimination of common names for subspecies in the forthcoming Check-list. The motion was seconded by David W. Johnston. Following further discussion of the matter by Mrs. Junea W. Kelly, Dr. Loye Miller, Robert I. Bowman, Howard Cogswell and others, the motion was unanimously carried.

Motion: That the Northern Division of the Cooper Ornithological Society desires to go on record as favoring the elimination of common or vernacular names for subspecies in the forthcoming A.O.U. Check-list on the grounds that provision of such names encourages their use with misleading implication of accuracy and that they are cumbersome and tend to cause confusion.

Motions that there be an April meeting but no September meeting were made and carried.

The speaker of the evening was Mr. George Treichel of the University's Geography Department who gave an illustrated talk on "Biogeography of the Island of Hispaniola with Special Reference to Its Avifauna."—JOSEPH G. HALL, *Acting Secretary*.

APRIL.—The monthly meeting of the Northern Division was held on April 1, 1954, at the University of California, Berkeley. The following names were proposed for membership by Mrs. Junea K. Kelly: Mrs. Lynn W. Hunton, 429 Merritt Ave., Oakland 10, Calif.; Mrs. Edward Hohfeld, 2108 Broadway, San Francisco 15, Calif.; and Mrs. John F. Shuman, 250 The Uplands, Berkeley 5, Calif.

Dr. G. W. Salt of the University of California at Davis spoke on "Bird Studies at Jackson Hole."—JOSEPH G. HALL, *Acting Secretary*.

MAY.—The monthly meeting of the Northern Division was held on May 6, 1954, at the University of California, Berkeley. The following names were proposed for membership: Robert Goelet, 546 5th Ave., New York 36, N.Y., by A. H. Miller; Ralph J. Raitt, Jr., Museum of Vertebrate Zoology, Berkeley, Calif., by David W. Johnston; Joseph G. Hall, Museum of Vertebrate Zoology, Berkeley, Calif., by Robert I. Bowman.

The speaker of the evening, Mr. Ian McMillan of Shandon, presented a talk on "Ecological Problems of Quail Production."—JOSEPH G. HALL, *Acting Secretary*.

SOUTHERN DIVISION

MARCH.—The monthly meeting of the Southern Division was held on March 30, 1954, at the Los Angeles County Museum, Los Angeles. The following names were proposed for membership: Daniel A. Belkin, 6255 Drexel Ave., Los Angeles 48, Calif., by T. R. Howell; Charles Andrew Hice, 12816 5th St., Garden Grove, Calif., by H. Howard; Mrs. Edna M. Lloyd, 430 W. 16th St., San Bernardino, Calif., and R. M. Reed, Route 5, Box 837, Escondido, Calif., both by J. C. von Bloeker; Prabhakar G. Karmarkar, "Swastik-House," 223/F Maredpalli Rd., Secundesakad, Deccan, India; Christopher K. McKeever, Box 63, Water Mill, N.Y.; Mrs. Harson A. Northrup, 358 E. Main St., Owatonna, Minn.; Dr. Knud Paludan, Vildtbiologisk Station, Kale pr. Ronde, Denmark; Dwight Platt, 1420 Ohio, Lawrence, Kans.; Walton Barden Sabin, 1490 New Scotland Rd., Slingerlands, N.Y., and Walter R. Spofford, Dept. of Anatomy, State Univ. Medical College, Syracuse, N.Y., all by C. V. Duff.

A motion to vacate the April meeting was duly made, seconded and carried.

Dr. Walter P. Taylor, zoologist and conservation expert, spoke on "Some Birds of the Saguaros."—DOROTHY E. GRONER, *Secretary*.

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Revised to June 1, 1954

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A

Abbott, Cyril E., 419 S. Poplar St., Centralia, Ill. 1947.

Abbott, Jackson M., 814 13th St., New Alexandria, Va. 1954.

Abdulali, Humayun, 75 Abdul Rehman St., Bombay 3, India. 1947.

Adams, Claude T., Dept. Biology, Univ. Florida, Gainesville, Fla. 1951.

Adams, I. C., Jr., Box 158, Columbia, Mo. 1942.

Adams, Shirley J., Box 557, Hawthorne, Calif. 1954.

Adams, William H., Jr., 8023 Sycamore St., New Orleans 18, La. 1952.

Adelson, Richard H., 34 Wensley Dr., Great Neck, N. Y. 1950.

Albright, Ray, Rt. 1, Box 277, Dayton, Ore. 1950.

Albro, Mary S., 51 Canyon Rd., Berkeley 4, Calif. 1928.

Alcorn, Gordon D., College of Puget Sound, Tacoma 6, Wash. 1942.

Alcorn, Joseph R., Rt. 1, Box 19–A, Fallon, Nev. 1939 (1947) [L.].

Aldrich, Elmer C., 5631 Camellia Ave., Sacramento 19, Calif. 1935.

Aldrich, John W., 21 W. Spring St., Alexandria, Va. 1942.

Alexander, Gordon, Dept. Biology, Univ. Colorado, Boulder, Colo. 1941.

Allen, Arthur A., Cornell University, Ithaca, N.Y. 1911.

Allen, Esther C., Camarillo State Hospital, Camarillo, Calif. 1951.

Allen, H. A., 607 S. Hill St., Los Angeles 14, Calif. 1949.

Allen, Lois H., 37 Mosswood Rd., Berkeley 4, Calif. 1945.

Allen, Walter I., 1830 Pepper Dr., Altadena, Calif. 1922 (1952) [L.].

Allis, Frederick A., 122 W. Fir St., Oxnard, Calif. 1950.

Alperin, Irwin, 2845 Ocean Ave., Brooklyn 35, N. Y. 1947.

Alvarez del Toro, Miguel, Apartado Postal No. 6, Tuxtla Gutierrez, Chiapas, Mexico. 1948.

Amadon, Dean, American Museum of Natural History, Central Park at 79th St., New York 24, N. Y. 1943.
Anderson, A. H., 3221 Kleindale Rd., Tucson, Ariz. 1932.
Anderson, Charles H., 1015 Connely Dr., Salinas, Calif. 1947.
Anderson, Earl A., 7335 N. Odell Ave., Chicago 13, Ill. 1952.
Anderson, Frank G., Dept. Sociology, Univ. Maryland, College Park, Md. 1951.
Anderson, Rudolph M., 58 Driveway, Ottawa, Ontario, Canada. 1916.
Anderson, William, Box 983, Los Banos, Calif. 1948.
Andrews, Arthur A., 75 Penfield Crescent, Brighton Sta., Rochester 10, N. Y. 1927.
Annan, Ormsby, 1059 Chatfield Rd., Winnetka, Ill. 1951.
Antevs, Ada, "The Corral," Globe, Ariz. 1946 (1947) [L.].
Appel, Thomas G., 128 Wheeler Ave., Pleasantville, N. Y. 1951.
Appelman, F. J., Rotterdam Zoo, Blydorp, Netherlands. 1953.
Applegarth, John H., Box 10, Calif. Polytechnic College, San Luis Obispo, Calif. 1937.
Appleton, J. S., R.F.D., Simi, Calif. 1901 (1920) [L.].
Arbib, Robert S., Jr., 231 W. Lena Ave., Freeport, N. Y. 1947.
Arend, Philip H., 10 Parrott St., Vallejo, Calif. 1949.
Armington, Sven, Box 19081, Stockholm 19, Sweden. 1951.
Armitage, Hal, 447 S. Mariposa Ave., Apt. 2, Los Angeles, Calif. 1953.
Armstrong, Fairbearn H., Box 97, Pomeroy, Wash. 1954.
Armstrong, Richard, 5326 Thomas St., Oakland, Calif. 1953.
Armstrong, Virginia, Old Concord Rd., South Lincoln, Mass. 1947.
Arnold, John R., 834 W. Mariposa St., Stockton, Calif. 1930.
Arnold, Lee W., Box 53, Cedarville, Calif. 1929.
Arnold, Ralph, 3162 Calle Fresno, Santa Barbara, Calif. 1893.
Arny, Samuel A., 6515 Williston Dr., Apt. 2, Falls Church, Va. 1947.
Aronoff, Arthur E., University Hospital, Ann Arbor, Mich. 1948.
Arsenault, Barbara J., 708–C Pine St., Santa Monica, Calif. 1954.
Arvey, M. Dale, Dept. Biology, Long Beach State College, Long Beach, Calif. 1953.
Ashcraft, Granville P., Box 329, Etna, Calif. 1940.
Ashley, James F., 740 Santa Clara Ave., Alameda, Calif. 1933.
Atkins, Carolyn C., 2924 Santa Cruz Dr., S. E., Albuquerque, N. M. 1949.
Atsatt, Sarah R., 405 Hilgard Ave., Los Angeles 24, Calif. 1911.
Austin, Mrs. Harold C., 1116 Mandana Blvd., Oakland 10, Calif. 1939.
Austin, John B., The Wohl, Apt. 1216, 2111 St. Charles Ave., New Orleans 13, La. 1948.
Austin, Oliver L., 28 Fairview Ave., Tuckahoe 7, N. Y. 1931.
Austin, Oliver L., Jr., ADTIC, R.S.I., Maxwell A.F.B., Ala. 1933.
Averitt, Max W., 2079 Randolph Dr., San Jose, Calif. 1950.
Ayer, Mrs. N. Edward, 1300 Hillcrest Dr., Pomona, Calif. 1929.

B

Badger, M. C., Rt. 1, Box 98, Santa Paula, Calif. 1915.
Bagg, Aaron M., 72 Fairfield Ave., Holyoke, Mass. 1952.
Bailey, Alfred M., Colorado Museum of Natural History, Denver 6, Colo. 1917.
Bailey, Laura B., Rockbridge, Alum Springs, Rt. 2, Goshen, Va. 1915 (1920) [L.].
Bailey, Richard, 1107 High Court, Berkeley 8, Calif. 1949.
Bailey, Robert E., Div. Anatomy, Univ. Tennessee, Memphis 3, Tenn. 1949.
Baily, A. Lang, III, Davenport Public Museum, 704 Brady St., Davenport, Iowa. 1952.
Baily, Fisher C., 1229 Ralston St., Reno, Nev. 1945.
Baker, Cora, 5111 42nd Ave., Sacramento, Calif. 1954.
Baker, John H., 1130 5th Ave., New York 28, N. Y. 1930.
Baker, Mildred E., 275 Hillcrest Dr., Encinitas, Calif. 1948.
Baker, Paul S., 19 Heckscher Dr., Huntington, L. I., N. Y. 1945.
Baker, Rollin H., Museum Natural History, Univ. Kansas, Lawrence, Kan. 1946.
Baldwin. Paul H., Dept. Zoology, Colorado A. & M. College, Fort Collins, Colo. 1943.
Baldwin, William G., Box 665, Quincy, Wash. 1953.
Ball, Grace E., 165 Eldridge St., Mill Valley, Calif. 1947.
Balsom, Mrs. Amos P., 2209 E. Stratford Court, Milwaukee 11, Wis. 1948.
Baltzar, Evelyn C., 9921 S. Overest Ave., Whittier, Calif. 1946.
Bard, Fred G., Provincial Museum, Public Health Bldg., Regina, Saskatchewan, Canada. 1948.
Barlow, Lynn B., 1017 Pine St., Santa Monica, Calif. 1953.
Barnes, F. R., 4282 Maple Ave., Oakland 2, Calif. 1947.
Barr, Evelyn, 362 N. Rexford Dr., Beverly Hills, Calif. 1952.
Barrett, Vernon, 1300 Chelton Way, South Pasadena, Calif. 1948.

Bartel, James N., 1741 Denison St., Pomona, Calif. 1951.
Bartholomew, George A., Jr., Dept. Zoology, Univ. California, Los Angeles 24, Calif. 1942.
Bartleson, Fred D., Dept. Biology, Univ. Florida, Gainesville, Fla. 1953.
Bassett, Frank N., 722 N. Orange Dr., Los Angeles 38, Calif. 1919.
Batchelder, Charles F., 7 Kirkland St., Cambridge 38, Mass. 1910.
Battles, Carroll D., 2347 S. Highland Ave., Los Angeles 16, Calif. 1924.
Batts, Henry L., Jr., 1211 Glenwood Ave., Kalamazoo, Mich. 1947.
Baumel, Julian J., Dept. Anatomy, School of *Medicine, Creighton Univ., Omaha 2, Nebr. 1953.*
Baumgardt, John, 523 Santa Rosa, Arcadia, Calif. 1937.
Baumgarten, Gail G., 258 Almont Dr., Beverly Hills, Calif. 1950.
Baxter, William, Jr., 1011 Trenton Pl., Wilmington, Del. 1947.
Beasley, Clarence C., 614 California Ave., Santa Monica, Calif. 1947.
Beebe, Hiram E., 1847 N. Wilcox Ave., Hollywood 28, Calif. 1948.
Beebe, William, N. Y. Zoological Soc. 185th St. and Southern Blvd., New York 60, N. Y. 1926.
Beecher, William J., Chicago Natural History Museum, Chicago 5, Ill. 1948.
Beemer, Eleanor G., Pauma Valley, Pala, Calif. 1946.
Behle, William H., Dept. Biology, Univ. Utah, Salt Lake City, Utah. 1933.
Beidleman, R. G., Zoology Dept., Colorado A. & M. College, Fort Collins, Colo. 1948.
Belcher, Sir Charles F., Kinangop, Kenya, East Africa. 1948.
Belcher, Paul E., 988 Jefferson Ave., Akron 2, Ohio. 1945.
Belkin, Daniel A., 6255 Drexel Ave., Los Angeles 48, Calif. 1954.
Bell, A. Weir, 365 S. Hoover St., Los Angeles 5, Calif. 1936.
Bell, Mrs. H. M. S., 742 St. Patrick St., Victoria, B. C., Canada. 1951.
Bellrose, Frank C., Illinois Natural History Survey, Havana, Ill. 1953.
Belt, R. Elmer, 1893 Wilshire Blvd., Los Angeles 5, Calif. 1942.
Bender, Richard O., Cobb's Mill Rd., R. D. 1, Bridgeton, N. J. 1951.
Benjamin, Gilbert G., Jr., Apt. 102, 2107 Hildarose Dr., Silver Spring, Md. 1939.
Bennett, Robert J., 3548 Steinway St., Astoria, L. I. C. 3, N. Y. 1954.
Bennett, Walter W., Box 19152, La Tijera Sta., Los Angeles 43, Calif. 1934.
Benson, Seth B., Museum Vertebrate Zoology, Berkeley 4, Calif. 1927.
Bent, A. C., 140 High St., Taunton, Mass. 1909 (1922) [L.], (1933) [Honorary].
Bentinck, Adrienne C., 2420 Scout Rd., Oakland 11, Calif. 1951.
Berger, Andrew J., Dept. Anatomy, East Medical Bldg., Univ. Michigan, Ann Arbor, Mich. 1947.
Berger, Daniel D., 5026 N. Elkhart Ave., Milwaukee 11, Wis. 1954.
Bergstrom, E. Alexander, 37 Old Brook Rd., West Hartford 7, Conn. 1942.
Berkey, Glen T., 22 S. State St., Rittman, Ohio. 1951.
Berry, Arthur L., 715 Orange Grove, Alhambra, Calif. 1942.
Berry, William D., 1651 Ard Eevin Ave., Glendale 2, Calif. 1951.
Berryman, Carl, 128 W. Euclid Ave., Stockton 4, Calif. 1953.
Bibbee, Paul C., Box 65, Athens, West Va. 1947.
Biddle, John A., 418 Westbourne St., La Jolla, Calif. 1947.
Bixler, Francis A., Box 1231, Powers, Ore. 1950.
Black, Mrs. O. F., 25 Panoramic Way, Berkeley 4, Calif. 1951.
Blackford, John L., Libby, Mont. 1952 (1952) [L.].
Blackstone, Robert E., 10363 Calvin Ave., Los Angeles 25, Calif. 1953.
Blain, Alexander W., 1028 Berkshire Rd., Grosse Pointe Park 30, Mich. 1926.
Blake, Charles H., Woodland Way, Lincoln, Mass. 1947.
Blanchard, Dean H., 729 Mission Canyon Rd., Santa Barbara, Calif. 1930.
Bleitz, Don, 2047 Castilian Dr., Hollywood 28, Calif. 1944 (1952) [L.].
Bliese, John C. W., Dept. Biology, Nebraska State Teachers College, Kearney, Nebr. 1953.
Bock, Walter, 7630 85th Dr., Woodhaven 21, N. Y. 1954.
Bodman, G. F., 105 Seymour St., Kamloops, B.C., Canada. 1953.
Boeker, Hal M., Co-op. Wildlife Research Unit, Colorado A. & M. College, Fort Collins, Colo. 1954.
Bohl, Wayne H., 1416 S. First St., Tucumcari, N. M. 1953.
Bolander, Gordon L., 538 Flower Ave., Santa Rosa, Calif. 1943.
Bond, Richard M., Virgin Islands Corp., Kingshill, St. Croix, U. S. Virgin Islands. 1936.
Bonestall, Aileen E., Dept. Bacteriology, Univ. California, Berkeley 4, Calif. 1954.
Booth, Ernest S., Dept. Biology, Walla Walla College, College Place, Wash. 1939.
Booth, Katherine F., 1085 Bank St., Plainesville, Ohio. 1953.
Borell, Adrey E., Box 1377, Soil Conservation Service, Oklahoma City, Okla. 1918.
Bosbyshell, F. H., 629 S. Spring St., Rm. 912, Los Angeles 14, Calif. 1951.

Boschma, H., Lange Raansteeg 2A, Leiden, Netherlands. 1952.
Boulton, Rudyerd, 3234 Reservoir Rd. N.W., Washington 7, D.C. 1939.
Bourne, Raymond D., Box 187, Oxford, Ohio. 1947 (1951) [L.].
Bowdish, B. S., Demarest, N.J. 1910.
Bowen, Lydia S., 841 Earlham St., Pasadena 4, Calif. 1948.
Bowers, Darl E., 2211 Grant St., Berkeley 3, Calif. 1949.
Bowers, J. Basil, 975 Juanita Ave., Campbell, Calif. 1947.
Bowman, Mabelle, 51 Marr Ave., Oakland, Calif. 1949.
Bowman, Robert I., Museum Vertebrate Zoology, Univ. California, Berkeley 4, Calif. 1948.
Boyd, Elizabeth M., 23 Jewett Lane, South Hadley, Mass. 1948.
Boyle, Ashby D., 61 University St., Salt Lake City, Utah. 1915.
Boyne, Elmer M., 624 Nixon, Reno, Nev. 1951.
Boynton, F. H., 163 W. State St., Pasadena 2, Calif. 1948.
Bracelin, Mrs. H. P., 2214 Vine St., Berkeley 7, Calif. 1930.
Brackbill, Hervey G., 4608 Springdale Ave., Baltimore 7, Md. 1945.
Bradburn, Donald M., 461 Pine St., New Orleans 18, La. 1953.
Braman, Myrtle, 206 W. Stayton Ave., Victoria, Tex. 1947.
Brandt, Herbert W., 2425 N. Park Blvd., Cleveland 6, Ohio. 1914.
Brauner, Joseph, 11233 Van Buren Ave., Los Angeles 44, Calif. 1946.
Brecher, Mrs. John, 70 Panoramic Way, Berkeley 4, Calif. 1952.
Briggs, Marjorie A., Dept. Biology, Univ. Florida, Gainesville, Fla. 1952.
Brittan, Martin R., 1820 Venus Dr., Sacramento 21, Calif. 1948.
Bro, Lysle W., Jr., 236 Palisades Ave., Santa Monica, Calif. 1952.
Broadbooks, Harold E., 14333 Corliss Ave., Seattle 33, Wash. 1942.
Brode, J. Stanley, Santa Monica Junior College, Santa Monica, Calif. 1934.
Brodkorb, Pierce, Dept. Biology, Univ. Florida, Gainesville, Fla. 1940.
Brodrick, Neva M., 721 Cleveland Ave., Oakland 6, Calif. 1949.
Broline, Signa L., 829 E. Claremont St., Pasadena 6, Calif. 1948.
Brooks, Matilda M., 630 Woodmont Ave., Berkeley, Calif. 1949.
Brooks, William E., Rt. 1, Box 100, Colton, Calif. 1940.
Brown, Asa L., Box 532, Herlong, Lassen Co., Calif. 1938.
Brown, Jerram L., 19 Hitchcock Rd., Amherst, Mass. 1952.
Brown, Ollie D., 8964 Wonderland Ave., Los Angeles 46, Calif. 1952.
Brown, Roger W., Box 933, Dixon, Calif. 1953.
Brown, Mrs. Thomas H., 9814 Estrella Dr., Spring Valley, Calif. 1946.
Browne, Andrew C., Lt.J.G., M.S.T.S., Box 203, Seward, Alaska. 1950.
Brubaker, Mrs. Lester H., 191 Mountain View Ave., San Jose 27, Calif. 1952.
Bruns, James H., St. Francisville, La. 1949.
Bryant, Harold C., 245 Glorietta Blvd., Orinda, Calif. 1910. (1920) [L.].
Bryant, Wayne W., Box 211, Yosemite National Park, Calif. 1952.
Bryens, Oscar McK., 231 S. Main St., Three Rivers, Mich. 1927.
Bull, D. Bernard, Box 608, La Mesa, Calif. 1950.
Bumbaugh, Ethel, 394 Orange St., Oakland 10, Calif. 1949.
Bunnell, Sterling, Jr., 2000 Broadway, San Francisco 15, Calif. 1952.
Burch, Jean, 43 Douglas Rd., Belmont 78, Mass. 1952.
Burch, Mrs. John Q., 4206 Halldale Ave., Los Angeles 62, Calif. 1947.
Burt, William H., Museum Zoology, Univ. Michigan, Ann Arbor, Mich. 1928.
Burtis, Prentis T., 2500 Edwards Ave., El Cerrito, Calif. 1949.
Bushman, John B., Ecological Research, Univ. Utah, Dugway, Utah. 1952.
Bushwitz, Henry W., 2218 S. Baker St., Santa Ana, Calif. 1950.
Byrd, Mitchell A., Co-op. Wildlife Research Unit, Virginia Polytechnic Inst., Blacksburg, Va. 1951.
Byrne, Hugh D., 1740 Maplewood Lane, Glenview, Ill. 1952.

C

Cade, Tom J., 526 Gayley St., Los Angeles 24, Calif. 1950.
Cady, Walter G., Norman Bridge Lab., California Inst. Tech., Pasadena 4, Calif. 1951.
Cahalane, Victor H., Rt. 1, Box 234–C, Alexandria, Va. 1938.
Calder, James A., Buena Park, Calif. 1917.
Camp, Charles L., Museum Paleontology, Univ. California, Berkeley 4, Calif. 1909.
Campbell, Raymond A., 686 Fourth Ave., Chula Vista, Calif. 1953.
Campbell, Ruth, 1810 Virginia St., Berkeley 3, Calif. 1952.
Campbell, Mrs. William H., 821 N. Sawtelle Ave., Tucson, Ariz. 1940.
Campbell, William I., 9 Barnesdale Ave. S., Hamilton, Ontario, Canada. 1948.
Caprini, Gladys M., 1807 Sacramento St., Vallejo, Calif. 1950.
Cardiff, Bruce E., R.F.D. 1, Cactus Ave., Rialto, Calif. 1948.

Cardiff, Eugene E., R.F.D. 1, Box 305–4, Rialto, Calif. 1947.
Carey, Joshua H., Dept. Neurology, Univ. Hospital, Ann Arbor, Mich. 1936.
Carnes, Mrs. Herbert E., 25 Kenwood Rd., Tenafly, N. J. 1947.
Carnie, S. Kent, 1249 Latham St., Mountain View, Calif. 1945.
Carpenter, Mrs. Fred A., 1430 Le Roy Ave., Berkeley 8, Calif. 1930.
Carpenter, Nelson K., 5026 Westminster Terr., San Diego 16, Calif. 1901.
Carson, Carl L., 67 Duncan Way, Oakland 11, Calif. 1948.
Carter, Frances, 2200 College Ave., Berkeley 4, Calif. 1934.
Cassel, J. Frank, Dept. Zoology, North Dakota Agr. College, Fargo, N. D. 1946.
Caswell, Herbert H., Jr., Zoology Dept., Cornell University, Ithaca, N. Y. 1950.
Cawelti, Wilfred E., Star Rt., Maricopa, Calif. 1941.
Chalif, Edward L., 37 Barnsdale Rd., Short Hills, N. J. 1948 (1952) [L.].
Chamberlain, Florence C., 4255 Lowell Dr., Des Moines 12, Iowa. 1954.
Chambers, Carl W., 514 Marquette St., Pacific Palisades, Los Angeles, Calif. 1936.
Chambers, W. Lee, R.R. 1, Box 294, Topanga, Calif. 1897 (1919) [L.], (1936) [Honorary].
Chapman, Larry E., 3822 Randolph Ave., Oakland 2, Calif. 1952.
Chapman, Lawrence B., R.F.D., Hubbardston, Mass. 1949.
Charde, Newell, 4607 Rosemont, La Crescenta, Calif. 1952.
Chattin, Susan E., Museum Vertebrate Zoology, Berkeley 4, Calif. 1927.
Cheney, Monte O., Box 24, Milo, Ore. 1953.
Childs, Henry E., 335 Pleasant St., Rumford 16, R. I. 1948.
Childs, Henry E., Jr., San Joaquin Experimental Range, O'Neals, Calif. 1947.
Christensen, Ruth, 7037 Alvern St., Apt. C, Los Angeles 45, Calif. 1953.
Christman, Gene M., R.F.D. 1, Cucamonga, Calif. 1946.
Church, Ronald L., 122 Eleventh St., Pacific Grove, Calif. 1954.
Clark, Donavan L., 601 Vanderwell Ave., West Covina, Calif. 1951.
Clark, Harold W., Angwin, Napa Co., Calif. 1948.
Clarke, Oscar F., 1012 Indianapolis Ave., Riverside, Calif. 1951.
Clarke, William S., Jr., Box 167, State College, Pa. 1948.
Clarkson, Mrs. Edwin O., Wing Haven, 248 Ridgewood Ave., Charlotte, N. C. 1945 (1953) [L.].
Clary, Marjorie D., 7630 Cimarron St., Los Angeles 47, Calif. 1929.
Clattenburg, Albert E., Jr., F. S. O. Nice, %Dept. of State, Washington 25, D. C. 1947.
Claxton, Fritz R., 2516 Etna St., Berkeley 4, Calif. 1949.
Clay, C. Irvin, Box 353, Eureka, Calif. 1910 (1923) [L.].
Clay, J. O., 169 Beach Dr., Victoria, B. C., Canada. 1953.
Cleary, John J., 1851 Braeburn Rd., Altadena, Calif. 1949.
Clements, H. Everest, 49 Stoneham Rd., Rochester 10, N.Y. 1951 (1951) [L.].
Clements, William F., 1500 N. Beverly Dr., Beverly Hills, Calif. 1952.
Clow, Marion, Box 163, Lake Forest, Ill. 1945.
Coakley, Katharine T., Mariposa, Calif. 1954.
Coble, Mary F., 1357 N. Stanley Dr., Hollywood 46, Calif. 1954.
Coggins, Herbert L., 2764 Filbert St., San Francisco 9, Calif. 1910.
Cogswell, Howard F., Dept. Biological Sciences, Mills College, Oakland 13, Calif. 1940.
Cohen, Ethel H., 2916 W. 14th St., Los Angeles 6, Calif. 1951.
Coil, E. Fisher, Bldg. 314, Stanford Village, Stanford University, Calif. 1951.
Coles, Victor, Teachers College, Univ. Cincinnati, Cincinnati 21, Ohio. 1947.
Collier, Gerald, 3634 N. Muscatel Ave., Rosemead, Calif. 1953.
Collins, Percy L., 18 Vanderbilt Ave., Milltown, N. J. 1951.
Colton, Harold S., Museum Northern Arizona, Box 601, Flagstaff, Ariz. 1936.
Combellack, C. Rose B., 3021 Friendly St., Eugene, Ore. 1952.
Comby, Julius H., 10044 Kratt Lane, Whittier, Calif. 1939.
Compton, Lawrence V., Biology Div., Soil Conservation Service, Washington 25, D. C. 1927.
Conan, Norman G., 1789 Fiske Ave., Pasadena 6, Calif. 1951.
Cone, Hutchinson I., Jr., 5911 Wilmett Rd., Bethesda, Md. 1940.
Congdon, Russell T., Medical Arts Bldg., Wenatchee, Wash. 1945.
Cook, Wilma B., "The Pine Cone," Box G–1, Carmel, Calif. 1947.
Cooper, Mrs. James S., 310 Howard Ave., Piedmont 11, Calif. 1944.
Cottam, Clarence, Fish and Wildlife Service, Dept. Interior, Washington 25, D. C. 1926.
Cottrell, George W., Jr., 70 Lake View Ave., Cambridge 38, Mass. 1945.
Couffer, Jack C., Canyon Films, 1213 N. Highland Ave., Hollywood 38, Calif. 1942.
Court, Edward J., 1723 Newton St. N.W., Mt. Pleasant, Washington, D. C. 1947.
Courtright, Mary L., 3 Elm Ave., Larkspur, Calif. 1936.
Covel, Paul F., 2860 Delaware St., Oakland 2, Calif. 1935.

Cowan, Ian McT., Dept. Zoology, Univ. British Columbia, Vancouver, B. C., Canada. 1937.
Cowan, John B., Gray Lodge Refuge, Box 655, Gridley, Calif. 1946.
Cowles, Raymond B., Zoology Dept., Univ. California, Los Angeles 24, Calif. 1928.
Cramer, Frances L., 921 W. 36th Pl., Los Angeles 7, Calif. 1940 (1943) [L.].
Craven, Harriet P., 2724 Fourth Ave., Sacramento 18, Calif. 1953.
Crawford, Franklin G., 2782 Glen Ave., Altadena, Calif. 1939.
Creager, Joe C., L. A. Cann Dr., Drawer 1267, Ponca City, Okla. 1948.
Crockett, Harry L., 76 E. Columbus Ave., Phoenix, Ariz. 1924.
Crompton, Alfred O., Laurie Ave., Salisbury, South Australia. 1948.
Crosby, John, Jr., Gardnerville, Nev. 1953.
Cross, Frank C., 9903 Thornwood Rd., Kensington, Md. 1950.
Crouch, James E., San Diego State College, San Diego, Calif. 1934.
Crymes, Frank H., 503 Beloit Ave., Berkeley 8, Calif. 1947.
Culbertson, A. E., Fresno State College, Fresno 4, Calif. 1937.
Cunningham, James W., 3009 E. 19th Terr., Kansas City 1, Mo. 1945.
Cunningham, John D., 1125–C 16th St., Santa Monica, Calif. 1952.
Curl, A. Laurence, 751 Balra Dr., El Cerrito 8, Calif. 1947.
Curtis, Vee K., 1450 Bancroft Way, Berkeley, Calif. 1945.
Cuthbert, N. L., 1001 S. Franklin St., Mount Pleasant, Mich. 1953.
Cutress, Charles E., Dept. Zoology, Univ. Hawaii, Honolulu 14, Hawaii. 1947.

D

Dahl, Richard G., 85 Byron Dr., Concord, Calif. 1938.
Dale, Fred H., Rt. 2, Box 258, Laurel, Md. 1937.
D'Angelo, Angelo R., 809 Palisade Ave., Union City, N. J. 1947.
Daniels, George G., 22 W. Beechcroft Rd., Short Hills, N. J. 1948.
Darby, Rolo E., 2103 Walnut Ave., Carmichael, Calif. 1946.
Darcus, S. J., Box 2206, R.R. 1, Penticton, B. C., Canada. 1950.
Dasmann, Raymond F., Div. Natural Science, Humboldt State College, Arcata, Calif. 1948.
Daugherty, Caroline H., 10527 Whitegate, Sunland, Calif. 1947.
Davenport, M. Christine, 817 Terraine Ave., Long Beach, Calif. 1952.
Davidson, John B., 123 E. 11th St., Santa Ana, Calif. 1950.
Davidson, W. M., 1504 Bodell St., Orlando, Fla. 1947.
Davis, Clifford V., Dept. Zoology, Montana State College, Bozeman, Mont. 1948.
Davis, David E., 615 N. Wolfe St., Baltimore 5, Md. 1936.
Davis, Edwin G., 1316 S. 22nd St. S., Arlington 2, Va. 1947.
Davis, Henry R., 418 Floral Park Terr., South Pasadena, Calif. 1953 (1953) [L.].
Davis, John, Hastings Natural History Reservation, Jamesburg Rt., Carmel Valley, Calif. 1938.
Davis. L. Irby, Box 988, Harlingen, Tex. 1940.
Davis, Platt, 117 E. 1st St., Albany, Ore. 1951.
Davis, William B., Box 254, Faculty Exchange, College Station, Tex. 1930 (1950) [L.].
Dawson, Richard G., 6114 Indiana Ave., Kansas City 4, Mo. 1949.
Dawson, William R., Dept. Zoology, Univ. Michigan, Ann Arbor, Mich. 1945.
Day, Leonard H., 212 E St., Davis, Calif. 1944.
Deane, Mrs. Ruthven, 830 Hibbard Rd., Winnetka, Ill. 1939 (1939) [L.].
DeGroot, Dudley S., Athletic Br., S.A.D., USAR–Eur., APO 245, % Postmaster, New York, N.Y. 1916.
Deignan, Herbert G., Smithsonian Institution, Washington 25, D. C. 1949.
Delacour, Jean, Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif. 1927 (1949) [L.].
De Lury, Ralph E., 330 Fairmont Ave., Ottawa 3, Ontario, Canada. 1926.
DeMay, Mawbelle, 504 E. Oak Ave., El Segundo, Calif. 1951.
Denham, Reginald, 100 Central Park South, New York 19, N. Y. 1948.
Denman, Clayton C., 1751 Naomi Pl., Seattle 5, Wash. 1949.
Dennis, Robert, 135 Purdue Ave., Berkeley 8, Calif. 1952.
Denton, J. Fred, 1510 Pendleton Rd., Augusta, Ga. 1949.
De Schaunsee, R. M., Jongleur Farm, S. Devon Ave., Devon, Pa. 1950.
Desmond, Thomas C., Box 670, Newburgh, N.Y. 1945 (1948) [L.].
Deuel, Harold F., 110 Hill St., Arcata, Calif. 1951.
Deuprey, Mrs. Clifton S., 542 Johnson St., Healdsburg, Calif. 1935.
Dexter, B. D., 2519 Ashby Ave., Berkeley 5, Calif. 1928.
Dick, John H., Dixie Plantation, Meggett, S. C. 1951.
Dickerman, Robert W., Museum of Natural History, Univ. Kansas, Lawrence, Kan. 1951.
Dietz, Curt, Box 3039, Stanford, Calif. 1950.

Dignam, John H., 4 Kinsington Ave., Willowdale, Ontario, Canada. 1954.
Dilger, William C., Laboratory of Ornithology, Fernow Hall, Cornell Univ., Ithaca, N.Y. 1952.
Dirks-Edmunds, Jane C., Linfield College, McMinnville, Ore. 1948.
Dix, Myrtle V., 509 Edgar Ave., Modesto, Calif. 1954.
Dixon, James B., R.D. 3, Box 1343, Escondido, Calif. 1924.
Dixon, James E., Rt. 5, Box 656, Escondido, Calif. 1948.
Dixon, Keith L., Dept. Wildlife Management, Texas A. & M. College, College Station, Texas. 1943.
Dixon, Ralph E., Box 981, Del Mar, Calif. 1935.
Dobson, Jerome J., Rt. 1, Box 144, Exeter, Calif. 1951.
Dodson, Leigh M., 351 N. Highland Ave., Los Angeles 36, Calif. 1929.
Doering, Hubert R., 82 E. Elm St., Chicago 11, Ill. 1946.
Doggett, William, 2125 Union St., Eureka, Calif. 1952.
Downs, Theodore, Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif. 1952.
Dresser, Mrs. James D., Jr., 9620 Von Thaden, Rt. 4, Wichita 15, Kan. 1951.
Driver, E. Raymond, Rt. 1, Box 234, Central Point, Ore. 1940.
Drummond, Charles T., Rt. 1, Box 93, Montague, Calif. 1952.
Du Bois, Alexander D., Christmas Lake Road, Rt. 4, Excelsior, Minn. 1911.
Du Bois, H. M., Rt. 1, Box 370, Clackamas, Ore. 1931.
Duff, C. V., 1922 Tamarind Ave., Hollywood 28, Calif. 1939 (1950) [L.].
Duff, James V., 1922 Tamarind Ave., Hollywood 28, Calif. 1946.
Duffield, Mrs. J. W., 4516 E. 54th St., Seattle 5, Wash. 1937.
Dumas, Philip C., Oregon State College, Corvallis, Ore. 1950.
Du Mont, Philip A., 4114 Fessenden St. N.W., Washington 16, D. C. 1932.
Dunlap, Ava K., 2817 Woolsey St., Berkeley 5, Calif. 1947.
Dunlap, Luther, 2817 Woolsey St., Berkeley 5, Calif. 1950.
Dunlap, Walter K., 103 Ardmore Rd., Berkeley 7, Calif. 1952.
Duvall, Allen J., Fish and Wildlife Service, Washington 25, D. C. 1946.

E

Eaton, Stephen W., Dept. Biological Sciences, St. Bonaventure Univ., St. Bonaventure, N.Y. 1948.
Eberhardt, Robert L., 804 30th St., San Pedro, Calif. 1948.
Ebert, Ruth B., 650 W. Stadium Dr., Apt. 4, Stockton, Calif. 1941.
Eckart, Mrs. William A., Box 184, Dutch Flat, Placer Co., Calif. 1951.
Eckelberry, Don R., 4 Foster Lane, Babylon, L. I., N. Y. 1948.
Edberg, Ragnar, Ekersgatan, 38 A–N B, Orebro 4, Sweden. 1953.
Eddy, Garrett, 4515 Ruffner St., Seattle 99, Wash. 1947.
Edens, Mrs. La Prelle, 4415 W. 5th St., Los Angeles 5, Calif. 1949.
Edge, Mrs. Charles N., 1215 5th Ave., New York 29, N. Y. 1932.
Edge, Elton R., 767 Scott Ave., San Bernardino, Calif. 1950.
Edson, J. M., 336 W. 50th St., Seattle 7, Wash. 1911.
Edwards, Ernest P., Camp Detrick, Frederick, Md. 1953.
Eichler, Herbert P., 2211 Andrews Ave., New York 503, N. Y. 1947.
Einarsen, Arthur S., 9 Edgewood Way, Corvallis, Ore. 1936.
Einhorn, Benjamin, 7 Parker Ave., Deal 1, N. J. 1947.
Eisenmann, Eugene, 11 Broadway, New York 4, N. Y. 1947 (1948) [L.].
Eklund, Carl M., Rocky Mountain Laboratory, Hamilton, Mont. 1951.
Eliot, Theodore L., 401 Golden Gate Ave., Belvedere, Calif. 1947.
Elmore, Louis A., 2002 Yolo Ave., Berkeley 7, Calif. 1935.
Emerson, Guy, 221 W. 57th St., New York 19, N. Y. 1936.
Emilio, S. Gilbert, Rt. 4, Laconia, N. H. 1926.
Emlen, John T., Jr., Zoology Dept., Birge Hall, Univ. Wisconsin, Madison 6, Wis. 1930.
England, Ewin G., Box 130, Durham, Calif. 1940.
English, P. F., Agricultural Educ. Bldg., Pennsylvania State Univ., State College, Pa. 1945.
Ennis, J. Harold, Cornell College, Mount Vernon, Iowa. 1953.
Erickson, John G., 610 N. Lilac Dr., Minneapolis 22, Minn. 1951.
Erickson, Mary M., 3505 Foothill Rd., Santa Barbara, Calif. 1930.
Erickson, Ray C., Malheur National Wildlife Refuge, Box 113, Burns, Ore. 1949.
Erlanger, Mrs. Milton, Box 305, Park Ave. 1, Elberon 1, N. J. 1948.
Erwin, Robert J., 731 W. Cahoon St., Ogden, Utah. 1948.
Esteban, Juan G., Instituto Miguel Lillo, Miguel Lillo 205, Tucuman, Argentina. 1949 (1949) [L.].
Evans, Will J., 547 Citrus Ave., Covina, Calif. 1952.
Evenden, Fred G., Jr., 3434 57th St., Sacramento 20, Calif. 1944.

Ewan, Joseph A., Dept. Botany, Tulane Univ., New Orleans 18, La. 1937.
Ewing, Anna M., 11072 Cashmere St., Los Angeles 49, Calif. 1953.
Ewing, Eva C., Box 734, Rancho Santa Fe, Calif. 1950.
Eyster, Marshall B., Dept. Biology, Southwestern Louisiana Institute, Box 545, Lafayette, La. 1951.

F

Fadness, Eleanor B., 822 Junipero St., Long Beach 4, Calif. 1950.
Failing, Robert, 3949 Harmon Rd., El Sobrante 11, Calif. 1933.
Fairbanks, Mrs. Paul H., U. S. Forest Service, Miramonte, Calif. 1952.
Falconer, Donald M., 37 Saddleback Rd., Rolling Hills, Calif. 1950.
Fargo, William G., 506 Union St., Jackson, Mich. 1928.
Farner, Donald S., Dept. Zoology, State College of Washington, Pulman, Wash. 1945.
Farrington, S. Kip, Jr., Main St., East Hampton, L. I., N. Y. 1952.
Featherstone, Mrs. W. H., 132 King St., Wallace, Idaho. 1951.
Fennell, Chester M., 21475 Hillsdale Ave., Fairview Park 26, Ohio. 1950.
Ficken, Robert W., 75 Nassau Rd., Oceanside, N. Y. 1953.
Field, Mrs. Oliver C., 1600 Espinosa Circle, Palos Verdes Estates, Calif. 1950.
Findley, James C., Museum of Natural History, Univ. Kansas, Lawrence, Kan. 1952.
Finley, Robert B., Jr., 7 Black Hawk Dr., Forest Heights, Washington 21, D. C. 1946.
Finninger, Paul C., 7654 Stewart St., Chicago 20, Ill. 1951.
Fischer, Rudolph, 215 E. Foothill Blvd., La Verne, Calif. 1947.
Fish, William R., 302-B Entwistle St., China Lake, Calif. 1948.
Fisher, Edna M., San Francisco State College, 19th Ave. and Holloway, San Francisco, Calif. 1923.
Fisher, Harvey I., Dept. Zoology, Univ. Illinois, Urbana, Ill. 1939.
Fisher, James, Old Rectory, Ashton, Northampton, England. 1951.
Fitch, Henry S., Univ. Kansas Natural History Reservation, Rt. 3, Lawrence, Kan. 1933.
Fitzpatrick, Walter J., Box 9, Yosemite National Park, Calif. 1947.
Fitzsimmons, Edward R., 1414 Bonita, Berkeley 9, Calif. 1952.
Fleckmann, May, 180 Clarence St., Apt. 6, Ottawa, Ontario. Canada. 1953.
Fleetwood, Raymond J., 324 N. 6th St., Socorro, N. M. 1952.
Fleming, Wesley B., Arizona Game and Fish Commission, Phoenix, Ariz. 1953.
Foerster, William X., East Brewster, Mass. 1952.
Follett, W. I., 3501 Broadway, Oakland 11, Calif. 1926 (1949) [L.].
Forbes, John R., 2751 Stockton Blvd., Sacramento, Calif. 1951.
Ford, Mary C., 2360 Scout Rd., Oakland 11, Calif. 1951.
Fordham, Stephen C., Jr., Delmar Game Farm, Delmar, N. Y. 1947.
Foree, Eve, 287 Alvarado Rd., Berkeley 5, Calif. 1950.
Foree, Lynn, 379 30th St., Oakland 9, Calif. 1950.
Forward, Mrs. Tracy C., Ione, Colo. 1952.
Fosberg, Maynard, Agronomy Dept., Agr. College and Exp. Sta., Univ. Idaho, Moscow, Idaho. 1941.
Foster, John H., Box 204, Wayne, Pa. 1952.
Foster, Thomas H., West Rd., Bennington, Vt. 1951.
Fox, Wade, Jr., Dept. Anatomy, School of Medicine, Louisiana State Univ., New Orleans 12, La. 1944.
Fredrickson, Richard W., 6-D Sunnyside, Lawrence, Kan. 1948.
Freeman, John M., Cortner Hall, Univ. Redlands, Redlands, Calif. 1954.
French, Mrs. C. T., 1801 Las Lomas, Albuquerque, N. M. 1945.
French, Norman R., Div. General Biology, Univ. Utah, Salt Lake City, Utah. 1951.
Friedmann, Herbert, U. S. National Museum, Washington, D. C. 1927.
Friling, Willy, 140 Chaussee de Malines, Antwerp, Belgium. 1952.
Fritz, Esther C., 102 The Uplands, Berkeley 5, Calif. 1935.
Froelich, Mrs. David E., 321 El Cerrito St., Piedmont, Calif. 1949.
Frohling, Lt. (J.G.) Robert C., U.S.S. Staten Island AGB-5, F.P.O., New York, N. Y. 1951.
Frost, Herbert H., Ricks College, Rexburg, Idaho. 1953.
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Gabrielson, Ira N., Rt. 2, Box 195, Vienna, Va. 1919.
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Gairloch, Stanley S., R.D. 2, North Scituate, R. I. 1948.
Gallizioli, Steve, Box 5, Pima, Ariz. 1951.
Gallup, Fred N., Box 614, Escondido, Calif. 1948.
Gamero, Antonio, 1837 N. Alexandria, Hollywood 27, Calif. 1949 (1950) [L.].
Gammell, Robert T., Kenmare, N. D. 1945.
Ganier, Albert F., 2112 Woodlawn Dr., Nashville 12, Tenn. 1939.
Gardner, Erle S., Box 67, Temecula, Calif. 1948.
Gardner, Leon L., 3129 Freeman St., San Diego 6, Calif. 1953.

Garner, William V., 447 E. Wadsworth St., Philadelphia 19, Pa. 1949.
Garrett, Lois, 1709 Chestnut St., Kenova, West Va. 1949.
Garrity, Devin A., 682 Forest Ave., Rye, N. Y. 1940.
Gasparec, Samuel, Box 88, Homer, Alaska. 1954.
Gazzola, Jack, 94 Forbes Ave., San Rafael, Calif. 1952.
Genelly, Richard E., Dept. Zoology, Univ. California, Davis, Calif. 1944.
Gensch, Robert H., 105 Clark Ave., Billings, Mont. 1940.
George, John L., Division Conservation, Vassar College, Poughkeepsie, N. Y. 1951.
George, William G., 1062 N. Branciforte Ave., Santa Cruz, Calif. 1941.
Gibb, Andrew S., 2664 Shasta Rd., Berkeley 8, Calif. 1938.
Gibson, Mrs. Carlos E., 9980 Beachy Ave., Pacoima, Calif. 1952.
Gibson, R. H., R.R. 2, Box 336, St. Helena, Calif. 1947.
Gifford, Harold, 3636 Burt St., Omaha 3, Nebr. 1916.
Gift, S/Sgt. Robert F., 935 Washington Ave., Lewisburg, Pa. 1951.
Giles, LeRoy W., 280 E. Front St., Fallon, Nev. 1952.
Gilhousen, Philip, R.D. 3, Box 3842, Arcata, Calif. 1947.
Gilliam, Helen L., 6124 Brookside Ave., Oakland, Calif. 1937.
Gilliard, E. T., 2253 Edsall Ave., New York 63, N. Y. 1951.
Gladding, Hope M., 970 Miller Ave., Berkeley 8, Calif. 1934.
Glass, Clem C., 4747 Alta Canyada R., La Canada, Calif. 1948.
Glover, Fred A., Patuxent Research Refuge, Laurel, Md. 1950.
Gloyd, Howard K., Chicago Acad. Sci., 2001 N. Clark St., Chicago 14, Ill. 1937.
Goebel, Herman, 78–52 80th St., Brooklyn 27, N. Y. 1947.
Goelet, Robert G., 546 Fifth Ave., New York 36, N. Y. 1954.
Goelitz, Walter A., Milford, Pa. 1915 (1920) [L.].
Goethe, C. M., Anglo Bank Bldg., 7th and J Sts., Sacramento 14, Calif. 1915.
Goetz, Christian J., 3503 Middleton Ave., Cincinnati 20, Ohio. 1945.
Golden, Robert V., 709 Van Buren Ave., Los Altos, Calif. 1952.
Goldman, Luther C., Box 739, San Benito, Tex. 1949.
Goldstein, Harry B., 5939 Addison St., Philadelphia 43, Pa. 1949.
Gollop, J. Bernard, Canadian Wildlife Service, Univ. Saskatchewan, Saskatoon, Saskatchewan, Canada. 1952.
Goodding, Leslie N., Rt. 1, St. David, Ariz. 1950.
Goodman, Don C., Dept. Zoology, Univ. Illinois, Urbana, Ill. 1952.
Goodman, Tom V., 732 S. Mansfield Ave., Los Angeles 36, Calif. 1954.
Gordon, Sidney P., Hachita, N. M. 1948.
Goss, Mildred K., Box 90, Mt. Hamilton Rd., San Jose, Calif. 1950.
Gould, Patrick J., 12137 Redberry, El Monte, Calif. 1951.
Graber, Richard R., W. W. C. 552, Norman, Okla. 1954.
Graf, William, Dept. Natural Sciences, San Jose State College, San Jose, Calif. 1948.
Graham, Alva G., 515 El Centro St., South Pasadena, Calif. 1948.
Graham, Hatch, 1106 Hall of Records, Los Angeles 12, Calif. 1937.
Graham, Hatch, Jr., % H. Graham, Sr., 1106 Hall of Records, Los Angeles 12, Calif. 1949.
Graham, J. Duncan, Benicia High School, Benicia, Calif. 1937.
Grange, Wallace, Sandhill Game Farm, Inc., Babcock, Wis. 1949.
Grant, Adele L., 6019 Overhill Dr., Los Angeles 43, Calif. 1946.
Greeley, Frederick, 15–B Univ. Houses, Eagle Hgts., Madison 5, Wis. 1948.
Green, Augusta L. C., % Toronto General Trusts, 350 Notre Dame W., Montreal, Canada. 1947.
Greene, Earle R., 534 D St., Oxnard, Calif. 1948.
Greenfield, Ray H., 1711 Mahani Loop, Honolulu 17, Hawaii. 1954.
Greenhalgh, Clifton M., Box 326, Murray, Utah. 1939.
Greenway, James C., Jr., Box 26, Wellesley, Mass. 1954.
Greer, Edward C., 422 E. 10th St., Davenport, Iowa. 1949.
Griffin, Homer V., Box 472, Ordway, Colo. 1952.
Griffith, Richard M., Jr., 3334 Volta Pl. N.W., Washington 7, D. C. 1944.
Grimm, William C., Rt. 2, Box 122–B, Georgetown, S. C. 1948.
Grinnell, Hilda W., 3016 Benvenue Ave., Berkeley, Calif. 1912 (1921) [L.], (1947) [Honorary].
Grinnell, Lawrence I., 710 Triphammer Rd., Ithaca, N. Y. 1949.
Griscom, Ludlow, Museum Comparative Zoology, Cambridge, Mass. 1933 (1949) [L.].
Groner, Dorothy E., 4038½ Garden Ave., Los Angeles 39, Calif. 1945.
Grootaers, Frans, Prinses Lydialaan 73, Heverlee, Leuven 1, Belgium. 1952.
Gross, Alfred O., 11 Boody St., Brunswick, Maine. 1923.
Grube, George E., Biology Dept., Gettysburg College, Gettysburg, Pa. 1947.
Gudmundsson, Finnur, Natturugripasafnid, Box 532, Reykjavik, Iceland. 1951.
Guest, Marjorie L., 380 National Ave., Chula Vista, Calif. 1942.

Guggolz, Jack, 685 Mesa Way, Richmond 2, Calif. 1940.
Guhl, A. M., Dept. Zoology, Kansas State College, Manhattan, Kan. 1949.
Gullion, Gordon W., 644 Oak St., Elko, Nev. 1947.
Gumbart, William B., Box 1936, New Haven 9, Conn. 1952.

H

Hagar, Mrs. Jack, Rockport Cottages, Box 508, Rockport, Texas. 1945.
Hague, Florence S., Dept. Biology, Sweet Briar College, Sweet Briar, Va. 1925.
Haines, Robert L., 54 E. Main St., Moorestown, N. J. 1953.
Hall, Edward M., 7620 S. College Ave., Whittier, Calif. 1937.
Hall, E. Raymond, Museum of Natural History, Univ. Kansas, Lawrence, Kan. 1924.
Hall, Joseph G., Museum Vertebrate Zoology, Univ. California, Berkeley 4, Calif. 1954.
Hall, Leonard, Possum Trot Farm, Caledonia, Mo. 1952.
Halladay, Daniel S., 628 E. Chestnut Ave., Santa Ana, Calif. 1910.
Haller, Capt. Karl W., AO–864839, Ward 6, 2750th USAF Hospital, Wright-Patterson AFB, Ohio, 1936 (1953) [L.].
Hallman, Roy C., Box 435, Port St. Joe, Fla. 1945.
Halloran, Arthur F., Box 1032, Yuma, Ariz. 1933.
Halstead, Kenneth R., 4137 N. E St., San Bernardino, Calif. 1941.
Halverson, Arthur W., 5705 W. Erie St., Chicago 44, Ill. 1948.
Hamerstrom, Frances, Plainfield, Wis. 1946.
Hamilton, Charles W., 2639 Fenwood, Houston 5, Texas. 1948.
Hamilton, G. Dale, 2550 Murray St., Shreveport 51, La. 1951.
Hamilton, John B., 616 Hot Springs Rd., Santa Barbara, Calif. 1945.
Hamilton, Terrell H., Box 4174, College Station, Texas. 1953.
Hamilton, William J., III, 615 Highland Rd., Ithaca, N. Y. 1954.
Hamlin, John W., 1855 White Oak Dr., Menlo Park, Calif. 1936.
Hamlin, Mrs. Mark L., 6433 Oakwood Dr., Oakland 11, Calif. 1949.
Hammond, Merrill C., Lower Souris Refuge, Upham. N. D. 1949.
Hampe, Irving E., 5559 Ashbourne Rd., Baltimore 27, Md. 1938.
Hand, Ralph L., 415 W. Central, Missoula, Mont. 1927 (1950) [L.].
Hann, Harry W., Dept. Zoology, Univ. Michigan, Ann Arbor, Mich. 1949.
Hanna, Wilson C., 721 N. 8th St., Colton, Calif. 1902 (1921) [L.].
Hansen, Charles G., Natural History Bldg., Oregon State College, Corvallis, Ore. 1952.
Hansen, Edward L., Oregon Co-op. Wildlife Research Unit, Oregon State College, Corvallis, Ore. 1952.
Hanson, Elmer C., 1305 Wisconsin Ave., Racine, Wis. 1947.
Hanson, Hugh, Arizona State College, Tempe, Ariz. 1949.
Hardy, Ross, Long Beach State College, Long Beach 4, Calif. 1938.
Hardy, William, 2015 McCord St., Murphysboro, Ill. 1953.
Hargrave, Lyndon L., Box 505, Benson, Ariz. 1931.
Harley, Ken L. S., 30 Gresham St., East Brisbane, SE. 1, Queensland, Australia. 1947.
Harper, Francis, 115 Ridgway St., Mount Holly, N. J. 1920.
Harris, Harry, 532 Neptune, Encinitas, Calif. 1911 (1920) [L.], (1950) [Honorary].
Harrison, Ed N., 1134 Glendon Ave., Los Angeles 24, Calif. 1931 (1941) [L.].
Harrison, Hal H., 1102 Highland St., Tarentum, Pa. 1947.
Hartman, Frank A., Hamilton Hall, Ohio State Univ., Columbus 10, Ohio. 1945.
Hartung, Esther M., 303 S. Church St., Grass Valley, Calif. 1923.
Harwell, C. A., 2630 Hilgard Ave., Berkeley 9, Calif. 1928.
Hastings, Frances S., 3525 Pacific Ave., San Francisco 18, Calif. 1948 (1948) [L.].
Hatch, Grenville, 2007–A Round Top Dr., Honolulu 14, Hawaii. 1952.
Hatton, Louise M., 200 Calera Canyon Rd., Salinas, Calif. 1932.
Havemeyer, Henry O., Mountain Side Farm, Mahwah, N. J. 1917.
Haverschmidt, Francois, Box 644, Paramaribo, Surinam, Dutch Guiana. 1946.
Hawbecker, Albert C., Fresno State College, Fresno 4, Calif. 1936.
Hawkins, Agnes, Rt. 4, Box 752, Phoenix, Ariz. 1954.
Hawkins, Leslie G., 1390–A 44th St., Los Alamos, N. M. 1941.
Hawkins, William R., 1928 N. Burkett Rd., El Monte, Calif. 1954.
Hayden, Christine B., 924 W. 55th St., Los Angeles 37, Calif. 1950.
Hayward, C. Lynn, Dept. Zoology, Brigham Young Univ., Provo, Utah. 1938.
Heaps, Pearl, 1916 Park Ave., Baltimore 17, Md. 1951.
Hebard, Frederick V., 1500 Walnut St. Bldg., Philadelphia 2, Pa. 1945.
Hebditch, Gerald A., 92 Rydes Hill Rd., Guilford, Surrey, England. 1952.
Hecht, William R., 3965–A Shenandoah, St. Louis 10, Mo. 1951.

Hedges, Harold C., Rt. 2, Lake Quivira, Kansas City 3, Kan. 1949.
Hedgpeth, Joel T., 1201 29th Ave., San Francisco 22, Calif. 1953.
Hedrick, Sanger, Jr., Royal Ranch, Simi, Calif. 1953.
Hefley, Harold M., Div. Biological Sciences, Mississippi Southern College, Box 94, Sta. A, Hattiesburg, Miss. 1945.
Helleiner, Frederick M., Box 3, Grande Prairie, Alberta, Canada. 1954.
Hemphill, Donald V., Pacific Union College, Box 438, Angwin, Calif. 1937.
Hendricks, Ann R., 38 Observatory Hill, Columbia, Mo. 1948.
Hendricks, Gene T., % C. E. Thompson, 900 S. Robberson Ave., Springfield, Mo. 1949.
Henningsen, Mrs. Harold P., 124 Cambridge Way, Piedmont 11, Calif. 1949.
Hensley, M. Max, Dept. Biology, Gettysburg College, Gettysburg 9, Pa. 1952.
Herbst, Lyle C., 10309 La Grange Ave., West Los Angeles 25, Calif. 1951.
Hering, Louise, 568 Marine, Boulder, Colo. 1947.
Herman, Carlton M., Patuxent Research Refuge, Laurel, Md. 1945.
Hersey, F. Seymour, Easton, Mass. 1915 (1920) [L.].
Hewitt, Oliver M., Fernow Hall, Cornell Univ., Ithaca, N. Y. 1953.
Hiatt, Naomi W., 338 N. Comstock Ave., Whittier, Calif. 1948.
Hice, Charles A., 12816 Fifth St., Garden Grove, Calif. 1954.
Hickey, Joseph J., 424 Univ. Farm Pl., Madison 5, Wis. 1946.
Hicks, Lawrence E., 8 Chatham Rd., Columbus, Ohio. 1936 (1936) [L.].
Hicks, Thomas W., Apt. 204–C, Flavet Village III, Gainesville, Fla. 1951 (1952) [L.].
Higgins, Harold G., 2965 S. 14th E., Salt Lake City, Utah. 1943.
Higgins, Thomas F., 85 Cornell St., Williston Park, N. Y. 1948.
Highley, Elmer E., 1050 Roosevelt St., Monterey, Calif. 1953.
Hildinger, Albert E., 1801 Lucile Ave., Los Angeles, Calif. 1952.
Hill, Harold M., 14 Clifton Court, Redlands, Calif. 1935.
Hill, Henry G., 465 S. 15th St., San Jose, Calif. 1953.
Hill, Herbert O., Box 983, Los Banos, Calif. 1945.
Hill, Mrs. Robert A., 104 Via Lorca, Newport Beach, Calif. 1950.
Hill, W. W., Dept. Anthropology, Univ. New Mexico, Albuquerque, N. M. 1950.
Hinchman, Richard M., 75 Fairbanks Rd., Milton 86, Mass. 1951.
Hinds, Frank J., 1749 W. Michigan Ave., Kalamazoo, Mich. 1942.
Hinshaw, Thomas D., 1827 San Juan Ave., Berkeley 7, Calif. 1931.
Hipple, Byron T., Jr., 114 Chestnut St., Albany 10, N. Y. 1951.
Hock, Raymond J., Arctic Health Research Center, Box 960, Anchorage, Alaska. 1950.
Hodges, Elizabeth D., 6214 Paseo, Kansas City 4, Mo. 1953.
Hodges, James, 324 W. 31st St., Davenport, Iowa. 1948.
Hoffman, Bess M., 1316 12th Ave., Los Angeles 19, Calif. 1949.
Hoffman, Russell R., Box 825–A, Kodiak, Alaska. 1954.
Hohfield, Lillian D., 2108 Broadway, San Francisco 15, Calif. 1954.
Holdenreid, Robert, Santa Fe Field Station, St. Michael's College, Santa Fe, N. M. 1940.
Holgersen, Holger, Stavanger Museum, Stavanger, Norway. 1952.
Holland, Harold M., Box 615, Galesburg, Ill. 1901 (1920) [L.].
Holliday, Jay N., Box 425, Northridge, Calif. 1949.
Hood, Mary V., 138 S. Wilton Dr., Los Angeles 4, Calif. 1940.
Hooper, David C., 4686½ W. Point Loma Blvd., San Diego 7, Calif. 1951.
Hoover, Theodore J., Rancho del Oso, Davenport, Santa Cruz County, Calif. 1898 (1916) [L.].
Horn, Frank E., 538 E. 21st St., Brooklyn 26, N. Y. 1954.
Hough, Mrs. John N., 1515 Mariposa, Boulder, Colo. 1947.
Howard, Hildegarde, Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif. 1924.
Howard, Walter E., Field Station Adm., Univ. California, Davis, Calif. 1948.
Howe, Elizabeth, 1843 N. Cherokee, Hollywood 28, Calif. 1949.
Howell, A. Brazier, Alna, Maine. 1908 (1915) [L.].
Howell, Joseph C., Zoology Dept., Univ. Tennessee, Knoxville, Tenn. 1949.
Howell, Thomas R., Dept. Zoology, Univ. California, Los Angeles 24, Calif. 1947.
Howell, Mrs. Thomas R., 405 Beloit Ave., Los Angeles 49, Calif. 1951.
Howes, Paul G., Bruce Museum, Bruce Park, Greenwich, Conn. 1951.
Howsley, L. R., Box 83–A, Simpson Lane, Fort Bragg, Calif. 1927.
Hoy, Nelson D., 500 Sharon Ave., Sharon Hill, Pa. 1944.
Hubbs, Carl L., Scripps Inst. Oceanography, La Jolla, Calif. 1945.
Huber, Barbara E., 1753 Correa Way, Los Angeles 49, Calif. 1953.
Huble, Jan, Waldamkaai 7, Gent, Belgium. 1953.

Hudson, George E., 303 Side St., Pullman, Wash. 1952.
Huey, Laurence M., Natural History Museum, Balboa Park, San Diego 1, Calif. 1909 (1916) [L.].
Hughes, Herbert E., 8622 W. Adams Blvd., Los Angeles, Calif. 1953.
Hughes, William H., 8755 S.W. Marine Dr., Vancouver 14, B.C., Canada. 1949.
Humphrey, Donald W., Box 644, St. Maries, Idaho. 1953.
Humphrey, Mrs. Harry B., 715 W. Fremont Ave., Los Altos, Calif. 1952.
Humphrey, Philip S., Museum Zoology, Univ. Michigan, Ann Arbor, Mich. 1950.
Hundley, Marion L., Box 43, Granville, Ohio. 1951.
Hunn, John T. S., 1218 Prospect Ave., Plainfield, N. J. 1939.
Huntington, Charles E., Dept. Biology, Bowdoin College, Brunswick, Maine. 1951.
Hunton, Mrs. Lynn W., 429 Merritt Ave., Oakland 10, Calif. 1954.
Hurd, Paul D., Jr., 112 Agr. Hall. Univ. California, Berkeley 4, Calif. 1940.
Hurley, John B., 401 S. 17th Ave., Yakima, Wash. 1921.
Hurley, Joseph G., 241 W. Stocker St., Glendale 2, Calif. 1953.
Hutchinson, Magdeleine C., 2640 Glendessary Lane, Santa Barbara, Calif. 1940.
Hyde, A. Sidney, 609 E. Georgia St., Gunnison, Colo. 1939.
Hyde, Mrs. Charles H., 12745 Gravelley Lake Dr. S.W., Tacoma, Wash. 1951.

I

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Ingles, Lloyd G., Biology Dept., Fresno State College, Fresno, Calif. 1936.
Irving, James G., Jr., Apt. L–1, 243 Johnson Ave., Hackensack, N. J. 1947.
Irwin, M. P. Stuart, % Marclay's Bank, Salisbury, Southern Rhodesia, Africa. 1952.
Isaac, Donald E., 6258 Highland Ave., Richmond 9, Calif. 1948.
Isham, Henry W., 460 Bellefontaine St., Pasadena, Calif. 1947.

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Jackson, Hartley H. T., Rm. 61, U.S. National Museum, Washington 25, D.C. 1921.
Jacobs, E. Bryan, Waynesburg, Pa. 1947.
Jacobsen, Eric C., Box 233, Ripon, Calif. 1950.
Jacot, Edouard C., 22 W. Islay St., Santa Barbara, Calif. 1923.
Jaeger, Edmund C., 4465 Sixth St., Riverside, Calif. 1922.
Jahn, Frances F., 10241 Chrysanthemum Lane, Los Angeles 24, Calif. 1948.
James, Douglas A., Dept. Zoology, Univ. Arkansas, Fayetteville, Ark. 1947.
Jamieson, Robert H., 761 West St., Reno, Nev. 1949.
Jaques, Francis L., East Oaks Rd., North Oaks Farms, St. Paul 8, Minn. 1945.
Jardine, James S., 18459 Lake Chabot Rd., Castro Valley, Calif. 1952.
Jefcoat, Arthur W., Inskop P. H., Paynes Creek, Calif. 1937 (1948) [L.].
Jeffrey, Robert G., Rt. 1, Box 517A, Stanwood, Wash. 1948.
Jenkins, Hubert O., 2116 Third Ave., Sacramento 18, Calif. 1933.
Jenkins, William J., Box 7, Olanta, S.C. 1951.
Jenks, Randolph, 2146 E. Fourth Street, Tucson, Ariz. 1931.
Jeter, Horace H., 4534 Fairfield Ave., Shreveport, La. 1950 (1951) [L.].
Jewett, Stanley G., 1404 Bidwell St. S.E., Portland 2, Ore. 1909 (1949) [Honorary].
Jobin, Leo, Box 6, Williams Lake, British Columbia, Canada. 1951.
Johnson, A. W., % Katz Johnson, S. A. C. Casilla 327, Santiago de Chile. 1951.
Johnson, Francis N., 111 Church St., Salinas, Calif. 1952.
Johnson, H. McClure, Div. Meteorology, Box 37, Roberts Hall, Cornell Univ., Ithaca, N.Y. 1952.
Johnson, H. V., 972 W. Broadway, Eugene, Ore. 1947.
Johnson, Myrtle E., 4647 55th St., San Diego 5, Calif. 1908.
Johnson, Ned K., 624 Lake St., Reno, Nev. 1950.
Johnson, Ray R., Jr., % J. C. von Bloeker, Jr., 161 W. 12th St., Los Angeles 61, Calif. 1950.
Johnson, Robert A., 98 East St., Oneonta, N.Y. 1945.
Johnston, David W., Dept. Biology, Mercer Univ., Macon, Ga. 1949.
Johnston, Richard F., Museum Vertebrate Zoology, Berkeley 4, Calif. 1947.
Johnston, Verna R., 1812 W. Sonoma Ave., Stockton, Calif. 1943.
Jones, Fred L., 3339 E. Griffith Way, Fresno, Calif. 1950.
Jones, F. Nowell, 14635 Whitfield Ave., Pacific Palisades, Calif. 1935.
Jones, George G., 2930 E. Third St., Tucson, Ariz. 1954.
Jones, George R., 17124 Celtic St., Granada Hills, Calif. 1950.
Jones, John C., 5810 Namakagan Rd., Glen Mar Park, Washington 16, D.C. 1940.
Jones, Joseph C., 3430 81st St., Jackson Heights, New York, N.Y. 1949.
Jones, S. Paul, 509 West Ave. N., Waukesha, Wis. 1929.
Jorae, Irene F., 601 S. Arnold, Mount Pleasant, Mich. 1945.
Jory, Mrs. Stafford L., 1370 Euclid Ave., Berkeley 8, Calif. 1936.

Juskiewicz, Frank, 306 State St., Sterling, Colo. 1952.

K

Kaerne, William H., Box 176, Winnipeg, Manitoba, Canada. 1952.
Kahl, Philip, 122 E. 47th St., Indianapolis, Ind. 1954.
Kalmbach, Edwin R., 2654 Forest St., Denver 7, Colo. 1923.
Kiminsky, Muriel, 1213 Robertson Way, Sacramento 18, Calif. 1953.
Karmarkar, Prabhakar G., "Swastik-House," 223/F Maredpalli Rd., Secunderabad, Deccan, India. 1954.
Karstens, Nicholas V., 460 Palmer Dr., Las Cruces, N. M. 1954.
Keating, Paul J., 6802 S. Lawrence St., Tacoma 9, Wash. 1952.
Keating, Ralph W. M., 816 N. Point St., San Francisco, Calif. 1951.
Kebless, Peter, 162 Van Winkle Ave., Garfield, N. J. 1947.
Keeton, Luther F., 80 Eastland Dr., Memphis, Tenn. 1944.
Keim, Frank T., 4240 E. Cheery Lynn, Phoenix, Ariz. 1944.
Kellogg, Louise, 672 15th St., Oakland 12, Calif. 1911 (1927) [L.].
Kellogg, Mildred, 2232 Piedmont Ave., Berkeley 4, Calif. 1921.
Kelly, Grace B., 1306 Bayview Pl., Berkeley 8, Calif. 1950.
Kelly, Junea W., 1311 Grand St., Alameda, Calif. 1918 (1949) [L.].
Kenaga, Eugene E., 1629 Isabella Rd., Rt. 5, Midland, Mich. 1951.
Kendeigh, S. Charles, Dept. Zoology, 201 Vivarium Bldg., Univ. Illinois, Wright and Healey Sts., Champaign, Ill. 1932.
Kent, Wyatt A., 683 S. Kingsley Dr., Los Angeles 5, Calif. 1940.
Kenyon, Karl W., 2725 Montlake Blvd., Seattle 2, Wash. 1934 (1950) [L.].
Kersey, Mrs. Glen B., % Castle Ayr, 1550 N. Lake Shore Dr., Chicago, Ill. 1951.
Kessel, Brina, Univ. Alaska, College, Alaska. 1951.
Killpack, Merlin L., Roosevelt, Utah. 1950.
Kimsey, J. Bruce, California Dept. Fish and Game, 926 J St., Sacramento 14, Calif. 1947.
Kincaid, Edgar B., Jr., 702 Park Pl., Austin, Tex. 1949.
King, James R., Dept. Zoology, Washington State College, Pullman, Wash. 1953.
Kingery, Hugh E., 2350 Colorado Blvd., Denver 7, Colo. 1951.
Kinsey, Eric C., Box 76, Manor, Calif. 1933.
Kirscher, William K., 2520 Marconi Ave., Sacramento 21, Calif. 1950.
Kloppenborg, Albert B., 901 E. 7th St. N., Newton, Iowa. 1954.
Kloss, Phillips, Box 735, Taos, N. M. 1930.
Knight, Howard, Weber College, Ogden, Utah. 1952.
Knorr, Owen A., Rt. 1, Box 53, Boulder, Colo. 1950.
Kobayashi, Keisuke, No. 2, I-chome, Shinohara-Kitamachi, Nada-ku (Rokko), Kobe, Japan. 1952.
Koford, Carl B., 123 Purdue Ave., Berkeley 8, Calif. 1939 (1944) [L.].
Kortright, Francis H., 633 Eastern Ave., Toronto 8, Ontario, Canada. 1945,
Kraak, W. K., Bussum, Josef Israelslaan 14, Netherlands. 1952.
Kraus, Douglas L., Univ. Rhode Island, Kingston, R. I. 1935.
Krehbiel, Adolph J., 221 Jefferson St., Clayton, N. M. 1951.
Kremers, Edward D., 2125 Mar Vista Ave., Altadena, Calif. 1953.
Kroll, Zerifa S., 608 W. Locust St., Lodi 3, Calif. 1948.
Krug, Bruce A., Box 405, Chesley, Ontario, Canada. 1945.
Krumm, Kenneth, Lacreek National Wildlife Refuge, Martin, S. D. 1954.
Krutzsch, Philip H., Museum Natural History, Univ. Kansas, Lawrence, Kan. 1947.
Kunkle, Donald E., 29 Edgewood Rd., Bloomfield, N. J. 1952.
Kuroda, Nagamichi, No. 1 Fukuyoshi-cho, Akasaka, Minato-ku, Tokyo, Japan. 1951.
Kyllingstad, Henry C., Arab States Fundamental Education Center, Sirs-el-Layyan, Menoufia, Egypt. 1944.

L

Laing, Hamilton M., Box 82, Comox, British Columbia, Canada. 1926.
Lamb, Chester C., Escobedo 69, Irapuato, Guanajuato, Mexico. 1899 (1953) [Honorary].
Lambert, Charles F., 444 W. Sycamore St., Willows, Calif. 1953.
Lancaster, Douglas A., 1332 Fifth St. N., Fargo, N. D. 1952.
Lane, Arnold, 2010 Hickory St., Santa Ana, Calif. 1947.
Langstroth, James H., Box 1130, Silver City, N. M. 1922.
Larrison, Earl J., Dept. Biological Sciences, Univ. Idaho, Moscow, Idaho. 1943.
Larson, Enid A., Box 2841, Carmel, Calif. 1952.
Larson, Mervin W., 2440 River Dr., Stockton, Calif. 1949.
Laskey, Amelia R., 1521 Graybar Lane, Nashville 12, Tenn. 1933.
Lasky, William R., 551 26th St., Santa Monica, Calif. 1948.
Lastreto, C. B., 605 Market St., San Francisco 5, Calif. 1913 (1948) [L.].
Latta, Katherine, 430 W. Moreland Ave., Philadelphia 18, Pa. 1952.

Laughlin, Robert M., 8-C Holder Hall, Princeton Univ., Princeton, N. J. 1952.
Lawrence, George E., 129 Columbus St., Bakersfield, Calif. 1947.
Leader, Harold, 2830 Motor Ave., Los Angeles 64, Calif. 1945.
Leavens, Mrs. Robert F., 1900 Yosemite Rd., Berkeley 7, Calif. 1928.
Lee, Levon, Rt. 1, Box 21-A, Santa Fe, N. M. 1941.
LeFebvre, Eugene A., 2300 E. Co. Rd. E., White Bear 10, Minn. 1953.
Legg, Ken, 173 Plateau Ave., Santa Cruz, Calif. 1954.
Leitch, Mary S., 1875 Greenfield Ave., Los Angeles 25, Calif. 1929.
Lelande, Harry J., 2657½ San Marino St., Los Angeles 6, Calif. 1901.
Lemieux, Louis, 1208 Albert Lozeau, Quebec 6, P. Q., Canada. 1951.
Lengemann, Martha A., 360 Cedar St., Imlay City, Mich. 1951.
Leopold, A. Starker, Museum Vertebrate Zoology, Univ. California, Berkeley 4, Calif. 1938.
Leupold, Norbert, 3555 S. E. Insley, Portland 2, Ore. 1951.
Lewin, Victor, Museum Vertebrate Zoology, Univ. California, Berkeley 4, Calif. 1954.
Lewis, Harrison F., West Middle Sable, Shelbourne Co., Nova Scotia, Canada. 1946.
Lewis, Mrs. Neil H., 212 N. Wilton Pl., Los Angeles 4, Calif. 1950.
Lieftinck, John E., % Goodyear, S. A., Luxembourg City, Luxembourg. 1947.
Ligon, J. Stokley, Box 950, Carlsbad, N. M. 1914.
Lincoln, Frederick C., Fish and Wildlife Service, Dept. Interior, Washington 25, D. C. 1922.
Lindau, S. Paul, 108 N. Harvard Blvd., Los Angeles, Calif. 1940.
Linford, James B., 538 Fairbanks Ave., Oakland 10, Calif. 1949.
Linsdale, Jean M., Hastings Natural History Reservation, Jamesburg Rt., Carmel Valley, Calif. 1926.
Linsley, Richard, 5550 Poplar Blvd., Los Angeles 32, Calif. 1948.
Linton, M. Albert, 315 E. Oak Ave., Moorestown, N. J. 1947.
Little, Luther, Casa Lomita, Rt. 1, Box 21-E, Littlerock, Calif. 1913 (1920) [L.]
Livermore, John W., 135 E. 54th St., Apt. 11-B, New York, N. Y. 1940.
Lloyd, Edna M., 430 N. 16th St., San Bernardino, Calif. 1954.
Lloyd, Hoyes, 582 Mariposa Ave., Rockcliffe Park, Ottawa, Ontario, Canada. 1923.
Locke, Louis, Apt. G-5, Aggie Villa, Davis, Calif. 1948.
Lockwood, Frank F., The Shoals, 1601 S. Coast Blvd., Laguna Beach, Calif. 1939.
Lockwood, Robert M., Veterans Admin. Hospital, McKinney, Tex. 1948.
Loetscher, Frederick W., Jr., 507 W. Main St., Danville, Ky. 1950.
Lofberg, Lila M., Star Rt., Roads End, Calif. 1925.
Long, Mrs. Albert E., 45 Clarendon Ave., San Francisco 14, Calif. 1951.
Longhurst, William M., Univ. California Field Sta., Box 305, Hopland, Calif. 1939.
Loring, George G., Bridge St., Manchester, Mass. 1951.
Lory, Daisy M., 497 Forest St., Oakland 9, Calif. 1936.
Louwman, P. W., Dierenpark Wassenaar, Rijksstraat Weg 667, Wassenaar, The Hague, Netherlands. 1952.
Lovell, Harvey B., 3011 Meade Ave., Louisville, 13, Ky. 1951.
Lovett, Constance, 1461 Alice St., Apt. 405, Oakland 12, Calif. 1951.
Low, Seth H., R. D. 2, Gaithersburg, Md. 1948 (1951) [L.].
Lowe, Charles H., Jr., Dept. Zoology, Univ. Arizona. 1950.
Lower, Bill R., 420 S. Sepulveda Blvd., Los Angeles 49, Calif. 1947.
Lowery, George H., Jr., Museum Zoology, Louisiana State Univ., Baton Rouge 3, La. 1938.
Lowney, Bruce S., 313 S. Beachwood Dr., Burbank, Calif. 1954.
Luckan, Louise A., 250 S. Wilton Pl., Los Angeles 41, Calif. 1948.
Lukens, Cmdr. R. R., 8205 Victoria Ave., Riverside, Calif. 1951.
Lukens, William W., Jr., Upper Gulph Rd., Radnor, Pa. 1947.
Lund, Gordon E., 839 Fourth St. E., Prince Albert, Saskatchewan, Canada. 1952.
Lunk, William A., 2849 Whitewood, Pittsfield Village, Ann Arbor, Mich. 1948.
Lynch, Jack, 926 Halladay, Santa Ana, Calif. 1949.
Lyon, Carleton B., 570 N. Rossmore, Los Angeles 4, Calif. 1949.
Lyon, Ray B., 1290 Foothill Blvd., San Luis Obispo, Calif. 1953.

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MacDonald, Kenneth F., 2912 S.E. 75th Ave., Portland 6, Ore. 1947.
MacFadyen, J. Ross, 1563 Washington, Denver 3, Colo. 1949.
MacGregor, Wallace G., Jr., 5525 North Ave., Carmichael, Calif. 1947.
Machris, Maurice A., 900 Wilshire Blvd., Los Angeles 17, Calif. 1949 (1953) [L.].
Mack, Horace G., % Gilson Mfg. Co., Ltd., Guelph, Ontario, Canada. 1945.
MacKay, Ronald H., Canadian Wildlife Service, Forestry and Geology Bldg., Univ. British Columbia, Vancouver, B. C., Canada. 1952.

MacKenzie, Locke, 829 Park Ave., New York 21, N. Y. 1947.
Maclean, R. Bruce, 2149 Panorama Terr., Los Angeles 39, Calif. 1947.
MacMillan, Jeanette C., 3330 Eastside Ave., Cincinnati 8, Ohio. 1952.
MacMullen, Ralph A., Box 97, The Heights, Mich. 1953.
MacNeill, C. Don, 4100 Day Ave., Apt. 2-C, Richmond 6, Calif. 1949.
Mahan, Margaret P., 4127 W. 62nd St., Los Angeles 43, Calif. 1942.
Maher, William J., 1831 E. 15th St., Brooklyn 29, N. Y. 1953.
Mailliard, Ernest C., 8 Cooper Lane, Sausalito, Calif. 1909.
Mair, Eileen L., 1023 H St., Apt. 3, Sacramento 14, Calif. 1952.
Mair, William W., Canadian Wildlife Service, Dept. Resources and Development, Ottawa, Ontario, Canada. 1953.
Mall, Rolf E., 2306 Harcourt Ave., Los Angeles 16, Calif. 1948.
Mallette, Robert D., 1935 Huston St., Marysville, Calif. 1948.
Mangels, Frederick P., 708 Farmers Ave., Bellmore, L. I., N. Y. 1954.
Mann, Lila M., 7537 E. Glencliff Dr., Downey, Calif. 1951.
Manning, Thomas H., 37 Linden Terr., Ottawa 1, Ontario, Canada. 1951.
Mannix, Lucille M., 11424 Cedar Rd., Apt. E–2, Cleveland 6, Ohio. 1948.
Mantle, Jack, 3113 E. Lester St., Tucson, Ariz. 1954.
Mapes, Russell B., 4835 Berryman St., Culver City, Calif. 1953.
Marfield, George R., 1820 S. Olive Ave., Alhambra, Calif. 1945.
Margolin, Abe S., 5631 N. 13th Dr., Phoenix, Ariz. 1948.
Marionneaux, Alice S., Central Romana Corp., La Romana, Dominican Republic. 1947.
Marks, Jack L., City of Portland Zoo, 400 S.W. Kingston Ave., Portland 1, Ore. 1951.
Marshall, Arthur P., Box 1067, Morro Bay, Calif. 1932.
Marshall, David B., Sacramento National Wildlife Refuge, Willows, Calif. 1946.
Marshall, Joe T., Jr., Dept. Zoology, Univ. Arizona, Tucson, Ariz. 1936.
Marshall, Perry R. F., Box 1199, Santa Barbara, Calif. 1948.
Martin del Campo, Rafael, Instituto de Biologia, Casa del Lago, Chapultepec, D.F., Mexico. 1948.
Mathews, Frank P., Rt. 6, Box 308, Olympia, Wash. 1950.
Mayfield, Harold F., 2557 Portsmouth Ave., Toledo 13, Ohio. 1947.
Mayhew, Wilbur W., 1002 Lake St., Apt. 2, Venice, Calif. 1946.
Mayr, Ernst, Museum Comparative Zoology, Harvard Univ., Cambridge 38, Mass. 1933.
Mazzeo, Rosario, 114 The Fenway, Boston 15, Mass. 1946.
McAllister, Tom, Jr., 3374 S.W. Fairmount, Portland 1, Ore. 1948.
McBride, Charlotte A., 2224 Via Guadalana, Palos Verdes Estates, Calif. 1954.
McCabe, Robert A., 424 University Farm Pl., Madison 5, Wis. 1947.
McCarty, John D., Jr., 1020 E. 21st St., Oakland, Calif. 1952.
McClure, H. Elliott, 406 Med. Gen. Lab., APO 500, % Postmaster, San Francisco, Calif. 1947.
McConoughey, Frank P., 1547 Northland Ave., Lakewood 7, Ohio. 1954.
McCoy, Edward D., Santa Maria Inn, Santa Maria, Calif. 1951.
McCulloch, Norman B., Jr., 1824 Corinth Ave., Los Angeles 25, Calif. 1951.
McDonald, Mrs. James R., 1042 Chestnut St., San Francisco, Calif. 1927 (1927) [L.].
McElroy, Mildred, 404 Gladstone Blvd., Shreveport, La. 1948.
McGranahan, Marjorie, 3352 Ardenridge Dr., Sacramento 21, Calif. 1952.
McGregor, May, 1580 N. Florida St., Banning, Calif. 1950.
McKeever, Christopher K., Box 63, Water Mill, N. Y. 1954.
McKenzie, Mrs. John C., Fort Ross. Cazadero, Calif. 1933.
McKnight, Edwin T., 5038 Park Pl., Washington 16, D. C. 1936.
McLean, Donald D., 2455 Cottle Ave., San Jose 25, Calif. 1916.
McManus, .William R., Memramcook, New Brunswick, Canada. 1931.
McMillan, Eben, Cholame, Calif. 1946.
McMillan, Ian I., Box 63, Shandon, Calif. 1945.
McNab, Brian, 2216 E. Burnside St., Portland, Ore. 1951.
McQuesten, Leavitt M., 120 Otis St., Santa Cruz, Calif. 1951.
McRae, Charles W., R. R. 2, Austell, Ga. 1954.
Medcalf, Robert W., 1431 S.W. Park Ave., Apt. 102, Portland 1, Ore. 1948.
Medina, Don, 364 Roswell Ave., Long Beach, Calif. 1954.
Mees, Martin, Koningen Emmaplein 7, Rotterdam, Netherlands. 1952.
Mein, William W., III, 1308 Canada Rd., Woodside, Calif. 1950.
Meinhardt, Hans, 62 Turk St., San Francisco 2, Calif. 1948.
Mellinger, E. O., Chincoteague National Wildlife Refuge, Box 62, Chincoteague, Va. 1947.
Mellor, N. H., 2724 Garretson, Corona, Calif. 1952.
Meng, Heinz K., 116 Miller St., Ithaca, N. Y. 1945 (1950) [L.].

Mengel, Jane S., 20 E. Shore Dr., Whitmore Lake, Mich. 1948.
Menninger, Phil B., 1724 Collins Ave., Topeka, Kan. 1948.
Merkel, Dalton E., 501 E. Pedragosa St., Santa Barbara, Calif. 1950.
Merkel, Terrence J., 2050 Fell St., San Francisco 17, Calif. 1950.
Merrill, Anne, 81 Beachview Crest, Toronto 13, Ontario, Canada. 1947.
Mers, William H., 1659 Marlowe Ave., Cincinnati 24, Ohio. 1951.
Metcalf, Homer N., Dept. Horticulture, Montana State College, Bozeman, Mont. 1945.
Meugens, Arthur L., 2636 Forbes St., Victoria, British Columbia, Canada. 1944.
Mewaldt, L. Richard, Div. Natural Sciences, San Jose State College, San Jose 14, Calif. 1947.
Meyer, James B., Jr., 4523 Firmament Ave., Encino, Calif. 1949.
Meyerriecks, Andrew J., Biological Laboratories, Harvard Univ., Cambridge 38, Mass. 1948.
Meyers, Ernest G., 847 Indian Rock Ave., Berkeley 7, Calif. 1946.
Michener, Josephine R., 418 N. Hudson Ave., Pasadena 4, Calif. 1934 (1942) [Honorary].
Mickey, Arthur B., 1516 Rainbow Ave., Laramie, Wyo. 1947.
Miller, Alden H., Museum Vertebrate Zoology, Berkeley 4, Calif. 1923 (1949) [L.].
Miller, August W., 218 E. 14th St., Live Oak, Calif. 1950.
Miller, Douglas S., 122 Lawrence Ave. E., Toronto, Ontario, Canada. 1953 (1953) [L.]
Miller, John L., 3310 W. Washington Blvd., Los Angeles 18, Calif. 1953.
Miller, Loye H., Museum Vertebrate Zoology, Berkeley 4, Calif. 1905 (1936) [Honorary], (1950) [L.].
Miller, Ralph H., 337 E. Bonnie Brae Court, Ontario, Calif. 1942.
Miller, Reginald C., 70 Stott Rd., Pietermaritzburg, Natal, South Africa. 1952.
Miller, Robert C., California Academy of Sciences, Golden Gate Park, San Francisco 18, Calif. 1921.
Miller, Thomas, 394 Grenola St., Pacific Palisades, Calif. 1937.
Mills, Monta A., 105 W. Avalon Dr., Pacific Manor, Sharp Park, Calif. 1952.
Milnes, Hattie K., 331 E. Gowen Ave., Mount Airy, Philadelphia, 19, Pa. 1953.
Milwain, Margaret J., 731 Alma Ave., Oakland 10, Calif. 1948.
Minturn, W. B., 2840 Mariposa St., Fresno 1, Calif. 1945.
Miskimen, Mildred, Miami Univ., Oxford, Ohio. 1953.
Mitchell, George J., Fish and Game Commission, Adm. Bldg., Edmonton, Alberta, Canada. 1949.
Mitchell, Mrs. Osborne, % Cobast, Caixa Postal 4965, Rio de Janeiro, Brazil. 1949.
Mitchell, Verda, 8220 S.W. 3rd Ave., Portland 1, Ore. 1951.
Mitchell, Viola J., 20 W. Vine St., Stockton, Calif. 1950.
Mitchell, W. I., 398 Vassar Ave., Berkeley 8, Calif. 1909.
Mocine, Ralph F., 2341 Cove Ave., Los Angeles 26, Calif. 1941.
Mock, Ronald M., 7436 McCool Ave., Los Angeles 45, Calif. 1948.
Moeller, B. A., 489 Prospect Terr., Pasadena 3, Calif. 1935.
Monk, Harry C., 406 Avoca St., Nashville 5, Tenn. 1925.
Monroe, Burt L., Ridge Rd., Anchorage, Ky. 1947.
Monroe, Ens. Burt L., Jr., USS Badoeng Strait, % FPO, San Francisco, Calif. 1954.
Monson, Gale W., Box 1717, Parker, Ariz. 1936.
Montgomery, Vester, 1302 N. Penn., Roswell, N. M. 1952.
Montrello, J. George, % Freiburg Mahogany Co., Apartado 146, Managua, Nicaragua. 1952.
Moody, Marjorie J., 1380 Veterans Ave., Apt. 1, Los Angeles 24, Calif. 1946.
Moody, Rollen W., 612 Harrison St., Denver 6, Colo. 1951.
Moore, Donald W., 211-A Mitscher Rd., China Lake, Calif. 1949.
Moore, Mrs. McBrayer, 335 W. Lexington St., Danville, Ky. 1951.
Moore, Robert T., 582 Meadow Grove Pl., Pasadena 3, Calif. 1911 (1947) [L.], (1950) [Honorary].
Moran, Robert B., 1335 Olive Lane, La Canada, Calif. 1901.
Morejohn, G. Victor, Jr., Rt. 1, Box 26, Davis, Calif. 1946.
Moreno, Abelardo, Museo Poey, Catedra U, Escuela de Ciencias, Universidad de la Habana, La Habana, Cuba. 1953.
Morony, John J., Jr., Box 1114, Alamo, Texas. 1952.
Morrish, Will F., 239 Glorietta Blvd., Orinda, Calif. 1951.
Morrow, Florence C., 11576 Lundy Lane, Los Altos, Calif. 1948.
Morrow, Mrs. John, 1320 N. State St., Chicago 10, Ill. 1947.
Moser, R. Allyn, 911 S. 89th St., Omaha 6, Nebr. 1940.
Mossman, A. S., Dept. Zoology, Univ. Wisconsin, Madison 5, Wis. 1950.
Mowbray, M. Vincent, 979 48th St., Los Alamos, N. M. 1937.
Mudge, Edmund W., Jr., 5926 Averill Way, Preston Hollow, Dallas 5, Tex. 1945.
Mueller, Frank D., 49 Radford Ave., Toronto, Ontario, Canada. 1951.
Mueller, Helmut C., 2756 N. Palmer St., Milwaukee 12, Wis. 1950.

Munger, Osgood H., 781 Gerth Ave., Salem, Ore. 1951.
Munro, George C., 3029 Hibiscus Dr., Honolulu 15, Hawaii. 1951.
Munro, J. A., Okanagan Landing, British Columbus, Canada. 1914.
Murdock, James, 311 Irving Ave., Glendale 1, Calif. 1938.
Murie, Adolph, Moose, Wyo. 1935.
Murie, Olaus J., Moose, Wyo. 1913.
Murphey, Carolyn F., 251 S. Norton Ave., Los Angeles 4, Calif. 1953 (1953) [L.].
Murphy, Grace E. Barstow, Briarlea, Old Field, Setauket, L. I., N. Y. 1952.
Murphy, Joseph R., 913 H St., Lincoln 8, Nebr. 1951.
Murphy, William B., 522 Hillgreen Dr., Beverly Hills, Calif. 1952.
Murray, George F., 10235 Stern Ave., Cupertino, Calif. 1950.
Murray, J. Laurence, Box 311, Compton, Calif. 1939.
Myers, Mary H., Box 690, Mecca, Calif. 1954.

N

Neeper, Irene, 6908 Hazeltine Ave., Van Nuys, Calif. 1954.
Neff, Johnson A., Wildlife Research Lab., Bldg. 45, Federal Center, Denver 2, Colo. 1920.
Neil, Richard W., Rt. 2, Box 305–AA, St. Helena, Calif. 1942.
Neldam, Mrs. George, 304 La Espiral, Orinda, Calif. 1949.
Nelson, Gideon E., Jr., Dept. Biology, Alabama College, Montevallo, Ala. 1951.
Nelson, Mrs. Roy F., 650 Blair Ave., Piedmont 11, Calif. 1947.
Nelson, Theodora, 315 E. 68th St., New York 21, N. Y. 1940.
Ness, Robert D., 17 Five Points Rd., Rush, N.Y. 1953.
Neville, Jack, 152 Peck Dr., Beverly Hills, Calif. 1953.
Newman, Joel S., Jr., 2132 Blanchard Ave., Anaheim, Calif. 1953.
Newman, Robert J., 312 W. Roosevelt St., Baton Rouge, La. 1952.
Newton, Earl T., 5145 Swope Parkway, Kansas City 4, Mo. 1942.
Nice, Margaret M., 5725 Harper Ave., Chicago 37, Ill. 1921 (1950) [L.].
Nichols, Charles K., 212 Hamilton Rd., Ridgewood, N. J. 1936.
Nichols, John T., American Museum Natural History, New York 24, N. Y. 1909.
Nichols, Mary J., Rt. 6, Box 685, Tucson, Ariz. 1939.
Nichols, Walter F., 2437 Lambert Dr., Pasadena 8, Calif. 1938.
Nicholson, Donald J., 1224 Palmer St., Orlando, Fla. 1911.
Nickell, Walter P., Cranbrook Inst. Science, Bloomfield Hills, Mich. 1947.
Nicoullaud, Jean, 48 Rue Descartes, Chinon, France. 1953.
Nielsen, Beatrice W., Rt. 1, Box 808, Kauffman Ave., Red Bluff, Calif. 1942.
Nielsen, Joseph A., 253 Warren St., Brooklyn 2, N. Y. 1954.
Noack, Harry R., 309 MacArthur Blvd., Oakland 10, Calif. 1901.
Nokes, I. D., 300 W. 121st St., Los Angeles 61, Calif. 1914.
Norman, Edward, Box 221, Deerfield, Mass. 1951.
Norris, Robert A., Dept. Zoology, Rutgers Univ., New Brunswick, N. J. 1949.
Norris, Russell T., 56 Spafford St., Newburyport, Mass. 1944.
Northrop, Mrs. Harson A., 358 E. Main St., Owatonna, Minn. 1954.
Norton, Peter, 115 Alpine Terr., Oakland 18, Calif. 1946.
Novaes, Fernando da Costa, Rua Tomeleros 186, Apd. 303, Copacabana, Rio de Janeiro, Brazil. 1951.
Nunes, R. Wayne, 520 Oatman Ave., Sanger, Calif. 1952.

O

Oakeson, Mrs. Nels, Star Rt., San Marcos Pass Rd., Santa Barbara, Calif. 1930.
Oberholser, Harry C., 2933 Berkshire Rd., Cleveland Hts., Cleveland 18, Ohio. 1904.
O'Connor, Esther L., 4344 Locust, Kansas City 4, Mo. 1946.
Odlum, Gordon C., Race Rocks Lightstation, % Pilotage Authority, 200 Dallas Rd., Victoria, British Columbia, Canada. 1948.
Odom, Mrs. Edgar R., Box 458, Orange, Texas, 1951.
Olson, Andrew C., Jr., San Diego State College B–173, San Diego 15, Calif. 1940.
Olson, Leo B., 835 S. First St., DeKalb, Ill. 1951.
O'Malley, Brendan M., Anchor Bldgs., Westport, County Mayo, Republic of Ireland. 1953.
O'Neil, Norah S., 1311 Bonham St., Commerce, Texas. 1951.
Ono, Masayuki, YMCA Dormitory, 19 Hsu Chang St., Taipei, Formosa, China. 1951.
Oppmann, Paul H., 13330 Detroit Ave., Lakewood 7, Ohio. 1950.
Orr, Mary T., Box 183, Reserve, N. M. 1946.
Orr, Robert T., California Academy of Sciences, Golden Gate Park, San Francisco 18, Calif. 1931.
Orth, Robert E., Box 774, Grand Ave., Elsinore, Calif. 1951.
Owre, Oscar, Jr., 2625 Newton Ave. S., Minneapolis 8, Minn. 1937.

P

Paine, Robert T., III, 2 Hubbard Park, Cambridge 38, Mass. 1950.
Painton, Harry R., 2817 Samarkand Dr., Santa Barbara, Calif. 1893 (1947) [Honorary].

Painton, Mrs. Harry R., 2817 Samarkand Dr., Santa Barbara, Calif. 1941 (1951) [L.].
Palmella, Duke of, 140 Rua da Escola Politecnica, Lisbon, Portugal. 1954.
Palmer, C. Mortimer, Jr., Box 414, Tombstone, Ariz. 1952.
Palmer, Fletcher G., Box 492, Placentia, Calif. 1942.
Palmer, Ralph S., New York State Museum, Albany 1, N. Y. 1951.
Palmer, Theodore S., 1939 Biltmore St. N.W., Washington, D. C. 1904 (1920) [L.], (1928) [Honorary].
Paludan, Knud, Vildtbiologisk Station, Ronde, Denmark. 1954.
Park, Charles F., Jr., School of Mineral Sciences, Stanford Univ., Stanford, Calif. 1947.
Parker, Clarence J., 821 N. Garfield Ave., Alhambra, Calif. 1938.
Parker, Dean R., Dept. Biology, Univ. Mississippi, University, Miss. 1945.
Parker, Margueritte D., 821 N. Garfield Ave., Alhambra, Calif. 1950.
Parker, Kenneth C., Section of Birds, Carnegie Museum, Pittsburgh 13, Pa. 1947.
Parmalee, Paul W., Illinois State Museum, Springfield, Ill. 1951.
Parsons, Lotta V., 1602 27th St., Sacramento 16, Calif. 1953.
Parsons, Robert P., 2677 Larkin St., San Francisco 9, Calif. 1951.
Patterson, John E., 2300 Siskiyou Blvd., Ashland, Ore. 1948.
Patterson, Mrs. O. M., Box 2, Pima, Ariz. 1950.
Patterson, Theresa H., 544 S. El Molino Ave., Pasadena, Calif. 1926 (1926) [L.].
Paul, Lucius H., 51 Riverview Pl., Rochester 8, N. Y. 1913.
Paulson, Richard E., Dept. Zoology, Univ. Chicago, Chicago 37, Ill. 1948.
Payne, Donald E., Rt. 4, Box 169, Hood River, Ore. 1946.
Payne, Everitt V., 18152 LeMay St., Reseda, Calif. 1951.
Paynter, Raymond A., Jr., Museum Comparative Zoology, Harvard Univ., Cambridge 38, Mass. 1946.
Pearse, Theed, Comox, Vancouver Island, British Columbia, Canada. 1927.
Pearson, Oliver P., Museum Vertebrate Zoology, Berkeley 4, Calif. 1948.
Pemberton, J. R., 714 W. Olympic Blvd., Los Angeles 15, Calif. 1900 (1928) [L.], (1949) [Honorary].
Pequegnat, Willis E., Zoology Dept., Pomona College, Claremont, Calif. 1937.
Perley, Mrs. Lyman O., 520 S. 31st St., No. 8, Omaha, Nebr. 1927 (1927) [L.].
Perring, Louise, 4821 Cedar Ave., Philadelphia 43, Pa. 1949.
Perry, Alfred E., Box 658, College Place, Wash. 1952.
Petersen, Peter C., Jr., 620 E. 30th St., Davenport, Iowa. 1953.
Peterson, George W., Box 725, Nogales, Ariz. 1950.
Peterson, James G., 3801 Blackford Ave., San Jose, Calif. 1934.
Peterson, Roger T., Box 7, Glen Echo, Md. 1939.
Pettingill, Olin S., Jr., 35 Sagamore Park, West Medford 55, Mass. 1934 (1948) [L.].
Peugh, Marguerite M., Apartado 16, Montemorelos, Nuevo Leon, Mexico. 1954.
Peyton, Laurence G., R. D. 2, Box 261, Fillmore, Calif. 1909 (1922) [L.].
Peyton, Sidney B., R. D. 2, Box 260, Fillmore, Calif. 1913 (1922) [L.].
Phelps, James H., 717 S. 4th Ave., Pocatello, Idaho. 1944.
Phelps, William H., Apartado 2009, Caracas, Venezuela. 1941.
Phelps, William H., Jr., Apartado 2009, Caracas, Venezuela. 1951.
Phillips, Allan R., 113 Olive Rd., Tucson, Ariz. 1933 (1948) [L.].
Phillips, William B., 137 W. 81st St., New York 24, N. Y. 1951.
Pickering, Robert, 66 Menno St., Waterloo, Ontario, Canada. 1952.
Pickett, Edwin R., 3940 N St., Sacramento 19, Calif. 1953.
Pierce, Fred J., Winthrop, Iowa. 1948.
Pierce, Robert A., Dept. Fish and Wildlife Resources, Kentucky Experimental Game Farm, Rt. 2, Frankfort, Ky. 1945.
Piercy, J. E., Denman Island, British Columbia, Canada. 1949.
Pinkas, Leo, California State Fisheries Lab., Terminal Island, San Pedro, Calif. 1953.
Pister, E. Philip, Rt. 1, Box 215, Stockton, Calif. 1949.
Pitelka, Frank A., Museum Vertebrate Zoology, Berkeley 4, Calif. 1940.
Piternick, George, 1634 Oxford St., Berkeley 9, Calif. 1951.
Platford, Sidney D., 152 W. Duarte Rd., Arcadia, Calif. 1935.
Plath, Karl, 110 S. Wesley Ave., Oak Park, Ill. 1954.
Platt, Dwight, Friends Rural Center, Rasulia, Hoshangabad, M. P., India. 1954.
Plymell, Florence, 1865 California St., San Francisco 9, Calif. 1950.
Polak, A. G., Spoorstraat 15, Amersfoort, Netherlands. 1953.
Poole, Cecil A., 1764 Topeka Ave., San Jose 26, Calif. 1941.
Porter, Eliot F., Rt. 1, Box 33, Santa Fe, N. M. 1946.
Porter, Richard D., Ecological Research, Bldg. 4050, D Area, Dugway Proving Ground, Tooele, Utah. 1949.
Porter, Sydney, The White Gates, 149 Stenson Rd., Derby, England. 1949.

Potter, Mrs. George C., 2111 Malvern Rd., Charlotte 7, N. C. 1951.
Pough, Richard H., 33 Highbrook Ave., Pelham 65, N. Y. 1926.
Poulson, Kathleen G., 1015 W. Clinton St., Fresno, Calif. 1954.
Poyser, Florence E., Box 1, Boulder City, Nev. 1952.
Pratt, Helen S., 2451 Ridge View Ave., Los Angeles 41, Calif. 1940.
Pray, Russell H., 662 Santa Rosa Ave., Berkeley 7, Calif. 1948.
Preble, Edward A., 3027 Newark St., Washington 8, D. C. 1926.
Prentice, Don S., Box 191, Phoenix, Ariz. 1953.
Prescott, Kenneth W., U. S. Naval Prep. School, U.S.N.T.C., Bainbridge, Md. 1947.
Presnall, Clifford C., 4923 Earlston Dr., Washington 16, D. C. 1931.
Price, John B., 532 Alvarado Row, Stanford, Calif. 1926.
Price, Ruth M., 5255 Glasgow Way, Los Angeles 45, Calif. 1942.
Pringle, Cornelia C., 1816 Vallejo St., San Francisco, Calif. 1915 (1921) [L.].
Pritchard, C. G., Wildlife Bldg., Fair Ground, Lincoln, Nebr. 1947.
Provin, Bruce F., 1316 Shattuck Ave., Berkeley 4, Calif. 1948.
Pruitt, Ben H., 5790 High Banks Rd., Springfield, Ore. 1947.
Pulich, Warren M., 2720 Frazier, Fort Worth, Texas. 1941.
Pursell, William M., 511 Neilson St., Berkeley 7, Calif. 1926.
Putman, William L., Dom. Entomological Lab., Vineland Sta., Ontario, Canada. 1947.
Pyle, Robert L., Box 949, Wahiawa, Oahu, Hawaii. 1950.

Q

Quaintance, Charles W., Eastern Oregon College of Education, La Grande, Ore. 1934.
Quattlebaum, W. D., 1925 Paloma St., Pasanea 7, Calif. 1945.
Quay, Wilbur B., Museum Zoology, Univ. Michigan, Ann Arbor, Mich. 1947.
Quigley, Raymond, Jr., 1400–B Lanning Dr., Whittier, Calif. 1937.

R

Ragan, Calvin, Box 7, Bell, Calif. 1952.
Raitt, Ralph J., Jr., Museum Vertebrate Zoology, Berkeley 4, Calif. 1954.
Ramey, Ralph E., Jr., 2313 Century Dr., Columbus 11, Ohio. 1952.
Ramsay, Alfred O., McDonogh School, McDonogh, Md. 1951.
Rand, Robert W., Box 251, Capetown, South Africa. 1947.
Randall, Clarence B., 38 Dearborn St., Chicago 3, Ill. 1951.
Randolph, Evan, Seminole and Chestnut Aves., Philadelphia 18, Pa. 1951.
Rankin, Herbert E., 5215 Vantage Ave., North Hollywood, Calif. 1949.
Rankin, Niall, House of Treshnish, Calgary, Isle of Mull, Scotland. 1952.
Ransom, Maud B., Box 557, Portland 7, Ore. 1952.
Ransom, Webster H., 9676 Evergreen Dr., Vuecrest, Bellevue, Wash. 1921.
Rapp, William F., Jr., 430 Ivy Ave., Crete, Nebr. 1941.
Rausch, Robert L., Arctic Hearth Research Center, Box 960, Anchorage, Alaska. 1952.
Ray, Mrs. Milton S., 64 Spencer Lane, Atherton, Calif. 1948.
Raymond, Francis, Box 2371, Laguna Beach, Calif. 1950.
Read, Bayard W., Upper Dogwood Lane, Rye, N. Y. 1949.
Rechnitzer, Andreas B., Scripps Inst. Oceanography, Univ. California, La Jolla, Calif. 1954.
Reed, Richard H., 4039 E. Fairmont Ave., Tucson, Ariz. 1947.
Reeder, William G., 4725 Brynhurst Ave., Los Angeles 43, Calif. 1946.
Rehfisch, Carol, 335 Delgado St., Santa Fe, N. M. 1951.
Reichert, Mrs. R. J., 14 W. 1st St., Mt. Vernon, N. Y. 1950.
Reis, C. O., 646 Juanita Ave., Los Angeles 4, Calif. 1917.
Renetzky, Andrew, 846 Higuera St., San Luis Obispo, Calif. 1949.
Retief, J. E., 56 Lincoln St., Bellville, Cape Province, South Africa. 1952.
Rett, E. Z., Museum of Natural History, Santa Barbara, Calif. 1937.
Reuther, Lt. Ronald T., 3304 Flt. Tng. Sq., Class 55–B, Box 284, Hondo AFB, Texas. 1946.
Reynolds, Harold C., Museum Vertebrate Zoology, Berkeley 4, Calif. 1946.
Reynolds, T. Eric, 140 Estates Dr., Piedmont 11, Calif. 1934.
Reynolds, Mrs. T. Eric, 140 Estates Dr., Piedmont 11, Calif. 1940.
Rice, Bertha M., Box 1147, San Jose, Calif. 1949.
Rich, C. Selwyn, 114 Champion Pl., Alhambra, Calif. 1939.
Richardson, Carl. Trail. Ore. 1925.
Richardson, Ethel E., 887 Indian Rock Ave., Berkeley 7, Calif. 1941.
Richardson, Frank, Dept. Zoology, Univ. Nevada, Reno, Nev. 1935.
Richardson, Walter L., Rt. 3, Box 1094, Porterville, Calif. 1943.
Richdale, Lancelot E., 23 Skibo St., Kew, Dunedin, New Zealand. 1944.
Richmond, Stanley M., 331 Eugene Medical Center, Eugene, Ore. 1951.

Richter, Carl H., 703 Main St., Oconto, Wis. 1948.
Rigby, Mrs. Douglas, Sedona, Ariz. 1951.
Riney, Thane, 18612 Crest Ave., Hayward, Calif. 1942.
Ripley, S. Dillon, Peabody Museum, New Haven 11, Conn. 1954.
Robbins, Lynn, Dept. Anatomy, Stanford Univ., Stanford, Calif. 1953.
Roberts, Bert, 6951 33rd St. N.W., Washington 15, D. C. 1947.
Roberts, Frances F., 1134 Glendon Ave., Los Angeles 24, Calif. 1942 (1943) [L.].
Roberts, Helen G., 4415 Clarissa Ave., Hollywood 27, Calif. 1947.
Robertson, D., Jr., Endiang, Alberta, Canada. 1949.
Robertson, Howard, 157 Wilton Dr., Los Angeles 4, Calif. 1896 (1926) [L.], (1949) [Honorary].
Robertson, John McB., 1677 W. Ninth St., Pomona, Calif. 1913 (1949) [Honorary].
Robinson, Roy G., Jr., 1320 W. 29th St., Los Angeles 7, Calif. 1952.
Rockefeller, William A., Rm. 2610, 52 Wall St., New York 5, N. Y. 1952.
Rodgers, Thomas L., Chico State College, Chico, Calif. 1937.
Rodia, Alfred, 402 S. Santa Cruz Ave., Modesto, Calif. 1952.
Roesler, M. Stuart, June Road, Cos Cob, Conn. 1949.
Roest, Aryan I., Central Oregon Commercial College, Bend, Ore. 1947.
Rogers, Caroline W., 1029 Vallejo St., Santa Rosa, Calif. 1938.
Rogers, Wallace, 715 Ellsworth Dr. N.W., Atlanta, Ga. 1952.
Romig, Mrs. Harry G., 351 Alma Real Dr., Pacific Palisades, Calif. 1952.
Ronkin, Raphael R., Dept. Biological Sciences, Univ. Delaware, Newark, Del. 1947.
Rooney, James, Jr., 1514 S. 12th Ave., Yakima, Wash. 1948.
Rosegay, Mrs. Harold, 7820 Brill Rd., Indian Hill, Cincinnati 27, Ohio. 1954.
Ross, Aaron B., 3417 Fillmore, Ogden, Utah. 1947.
Ross, C. Chandler, 7924 Lincoln Dr., Philadelphia 18, Pa. 1948.
Ross, Hollis T., 29 S. Second St., Lewisburg, Pa. 1936.
Ross, Roland C., 1820 Bushnell Ave., South Pasadena, Calif. 1920.
Roth, Edgar S., 107 N. Fuller St., Los Angeles, Calif. 1949.
Roullard, Fred P., 1015 Weldon Ave., Fresno 4, Calif. 1949.
Rowinski, Ludwig J., 17 Schneider Pl., Passaic, N. J. 1948.
Rowley, J. Stuart, 11 W. McLean St., Alhambra, Calif. 1928.
Rubey, William W., 16 Westwood Dr., Washington 16, D. C. 1949.
Rudd, Clayton G., 315 Medical Arts. Bldg., Minneapolis 2, Minn. 1945.
Rudd, Robert L., Dept. Zoology, Univ. California, Davis, Calif. 1939.
Rudkin, Francis H., Jr., 458 Fillmore St., Fillmore, Calif. 1950.
Ruffner, Albert B., 1072 Trestle Glen Rd., Oakland 10, Calif. 1950.
Russell, Richard W., Museum Vertebrate Zoology, Berkeley 4, Calif. 1954.
Russell, Ward C., Museum Vertebrate Zoology, Berkeley 4, Calif. 1930.
Rycraft, Thomas M., 427 E. Third St., Watsonville, Calif. 1950.
Ryder, Lt. (J.G., Ronald A., USS Burton Island (AGB–1), FPO, San Francisco, Calif. 1949.
Ryser, Fred A., Jr., Biology Dept., Univ. Nevada, Reno, Nev. 1954.

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Sabin, Walton B., 1490 New Scotland Rd., Slingerslands, N. Y. 1954.
Sabine, Winifred S., 503 Triphammer Rd., Ithaca, N. Y. 1949.
Salt, George W., Dept. Zoology, Univ. California, Davis, Calif. 1947.
Sampson, Walter B., 1005 N. San Joaquin St., Stockton 18, Calif. 1894.
Sams, James R., 4348 Hilldale Rd., Kensington, Calif. 1944.
Samuels, David L., 500 Walsh Rd., Atherton, Calif. 1952.
Sanchez-Mejorada, Carlos, Jr., Montes Urales 632, Lomas de Chapultepec, Mexico City, Mexico. 1948.
Sanders, Earl, Howard Payne College, Brownwood, Texas. 1946.
Sather, Carlyle W., 1290 Grove St., Apt. 204, San Francisco 17, Calif. 1952.
Satter, John M., 4500 Millersville Rd., Indianapolis 5, Ind. 1954.
Saugstad, N. Stanley, Rt. 4, Minot, N. D. 1948.
Saunders, Aretas A., Box 141, Canaan, Conn. 1909.
Savage, James, Elicott Square, Buffalo 3, N. Y. 1937.
Sawyer, E. W., 425 June St., Los Angeles 4, Calif. 1952.
Schadle, Daniel P., 1029 E. Tuckey Lane, Phoenix, Ariz. 1954.
Schaefer, Hugh F., 825 Merchants Rd., Rochester 9, N. Y. 1946.
Schmidt, Harold A., 317 E. El Segundo Blvd., Los Angeles 61, Calif. 1952.
Schmidt, Thomas B., 3700 Sharon St., Harrisburg, Pa. 1948.
Schneider, Fred A., % Warren Dried Fruit Co., San Jose, Calif. 1893 (1949) [Honorary].
Schoenborn, Harry, Rt. 1, Box 164, Molalla, Ore. 1950.

Scholes, Robert T., Bushnell, Ill. 1948.
Schonert, Richard, 1021 El Vecino, Modesto, Calif. 1949.
Schorger, A. W., 168 N. Prospect Ave., Madison 5, Wis. 1928.
Schramm, Wilson C., 321 Lensington Rd., Sycamore 10, N. Y. 1954.
Schultz, Mrs. Robert, 22809 W. 53rd Ave., Edmonds, Wash. 1951.
Schulz, Kenneth R., 4008 Rhoda Ave., Oakland 2, Calif. 1949.
Schumacher, Mrs. Hall L., 7027 Sycamore Ave., Seattle 7, Wash. 1953.
Schumm, William G., 302 C St., La Porte, Ind. 1945.
Schuster, Robert O., 3932 Ardley Ave., Oakland 2, Calif. 1945.
Schwartz, Paul A., Jr., Apartado 1766, % York Venezuela, Caracas, Venezuela. 1952.
Schweitzer, Robert D., 1 Blackstone Pl., Riverdale 71, N. Y. 1954.
Schwilling, Marvin, Box 864, Garden City, Kan. 1950.
Scott, Dorothy D., 1508 La Loma Ave., Berkeley 8, Calif. 1936.
Scott, Frederic R., 27 Malvern Ave., Apt. 2, Richmond 21, Va. 1947.
Scott, Harriet E., 2741 Woolsey St., Berkeley 5, Calif. 1942.
Scott, Oliver K., 437 E. 13th St., Casper, Wyo. 1952.
Scott, Tom K., Vet. Unit O–17, Pomona College, Claremont, Calif. 1952.
Scott, Walter, 5372 Bradford Ave., Placentia, Calif. 1947.
Sealander, J. A., Zoology Dept., Univ. Arkansas, Fayetteville, Ark. 1954.
Sebastian, Irene, Box 552, Palmdale, Calif. 1938.
Seeber, Edward L., 213 Columbia St., Ithaca, N. Y. 1946.
Sehl, Robert H., 7027 Hegerman St., Philadelphia 35, Pa. 1952.
Seibert, Henri C., Dept. Zoology, Ohio Univ., Athens, Ohio. 1947.
Seibert, Milton L., Jr., 906 N. Fourth St., San Jose 11, Calif. 1937.
Selander, Robert K., Museum Vertebrate Zoology, Berkeley 4, Calif. 1948.
Selle, Raymond M., 1562 Munson Ave., Los Angeles 42, Calif. 1948.
Severaid, J. Harold, Dept. Life Sciences, Sacramento State College, Sacramento 19, Calif. 1946.
Seymour, Peter O., 304 Village Court, San Jose, Calif. 1951.
Shackleton, Walter H., Rt. 1, Box 76–A, Prospect, Ky. 1953.
Shaftesbury, A. D., Dept. Zoology, Women's College, Univ. North Carolina, Greensboro, N. C. 1945.
Shaub, Benjamin M., 159 Elm St., Northampton, Mass. 1948.
Shaughnessy, Winslow M., 657 Forest Ave., Glen Ellyn, Ill. 1954.
Shaw, Catherine D., 7142 Marshfield Way, Hollywood 46, Calif. 1951.
Shaw, Charles R., 554 Ursuline Dr., Baton Rouge, La. 1949.
Sheffler, Dorothy E., 4731 Angeles Vista Blvd., Los Angeles 43, Calif. 1949.
Sheffler, W. J., 4731 Angeles Vista Blvd., Los Angeles 43, Calif. 1930 (1937) [L.].
Shellim, Maurice A., 7 Middleton Mansions, Calcutta 16, India. 1952.
Shelton, Leonard A., 313 First National Bldg., Pomona, Calif. 1945.
Shepard, Frank P., Jr., Meadow Lane, Greenwich, Conn. 1951.
Sherman, George L., Upper Lake, Calif. 1946.
Short, Lester L., Jr., 179 John St., Ilion, N. Y. 1954.
Shufeldt, Robert W., 4201 S. Four Mile Run Dr., Arlington 4, Va. 1948.
Shuman, Mrs. John F., 250 The Uplands, Berkeley 5, Calif. 1954.
Sibley, Charles G., Fernow Hall, Cornell Univ., Ithaca, N. Y. 1938 (1953) [L.].
Sibley, Gretchen, 4721 Ninth Ave., Apt. 3, Los Angeles 43, Calif. 1950.
Simmons, Edward M., % E. A. McIlhenny, Avery Island, La. 1943 (1943) [L.].
Simmons, Mrs. William W., 2742 N. Maryland Ave., Milwaukee 11, Wis. 1945.
Simpson, Roxie C., 6624 First St. N.W., Washington 12, D. C. 1948.
Sims, Mrs. R. M., 36 Hillcrest Rd., Berkeley 5, Calif. 1933.
Singleton, Albert R., 3968 Marburg Ave., Cincinnati 9, Ohio. 1949.
Skelton, Kathleen G., 353 W. 57th St., New York 19, N. Y. 1952 (1952) [L.].
Skillen, Donald R., 530 Georgian Rd., Pasadena 2, Calif. 1927.
Skinner, Milton P., 438 Locust Ave., Long Beach 2, Calif. 1915 (1920) [L.].
Skutch, Alexander F., San Isidro del General, Costa Rica. 1944.
Small, Arnold, 614 San Emidio St., Taft, Calif. 1954.
Smalley, Alfred E., 608 N. Main St., Barbourville, Ky. 1953.
Smalley, Jack A., 1891 Dennison St., Pomona, Calif. 1952.
Smith, Clarence F., 1152 Laurel St., Berkeley, Calif. 1928.
Smith, Edward W., Rt. 3, Box 698, Oregon City, Ore. 1951.
Smith, Emily D., 19651 Glen Una Dr., Los Gatos, Calif. 1921.
Smith, Harry M., 1602 State St., Columbus, Ind. 1952.
Smith, Josephine E., 51 Canyon Rd., Berkeley 4, Calif. 1928.

Smith, Loris P., 2560 61st Ave., Oakland 5, Calif. 1930.
Smith, Mrs. Otis H., 207 Alexander Ave., Larkspur, Calif. 1934.
Smith, Robert L., R. D. 1, Reynoldsville, Pa. 1947.
Smith, Thomas A., 843 Indian Rock Ave., Berkeley 7, Calif. 1942.
Smith, W. Glen, Box 240, Little Mountain Camp, Vancouver 13, British Columbia, Canada. 1952.
Smith, X. Martin, 816 S. Windsor Blvd., Los Angeles 5, Calif. 1948.
Snell, Charles H., 4915 48th Ave., Red Deer, Alberta, Canada. 1926.
Snow, Angeline W., 21441 Roaring Water Way, Los Gatos, Calif. 1950.
Snyder, Dorothy E., The Peabody Museum, 161 Essex St., Salem, Mass. 1952.
Snyder, Frank E., 4206 Newdale Dr., Los Angeles 27, Calif. 1952.
Snyder, L. L., Royal Ontario Museum, 100 Queens Park, Toronto 5, Ontario, Canada. 1924.
Sooter, Clarence A., U. S. Public Health Service, Box 625, Greeley, Colo. 1945.
Sowls, Lyle K., Rm. 205, Education Bldg., Univ. Arizona, Tucson. Ariz. 1951.
Spackman, G. Donald, Jr., Hill Farm, Coatesville, Pa. 1952.
Speire, Mrs. J. Murray, Cobble Hill, R. R. 2, Pickering, Ontario, Canada. 1945.
Spencer, Don, Berkshire Game Farm, 271 Madison Ave., New York 16, N. Y. 1953.
Spofford, Walter R., Dept. Anatomy, State Univ. Medical College, Syracuse, N. Y. 1954.
Sprick, Mrs. George B., 215 Santa Fe Ave., Hamden 14, Conn. 1951.
Sprinkle, Roger, 423 Indiana Ave., Chinook, Mont. 1936.
Sprunt, Alexander, IV, 1051 Cragmont Ave., Berkeley 4, Calif. 1952.
Staebler, Arthur E., W. K. Kellogg Bird Sanctuary, Hickory Corners, Mich. 1945.
Stager, Kenneth E., Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif. 1935.
Stallcup, William B., Biology Dept., Southern Methodist Univ., Dallas, Texas. 1951.
Stanley, Emerson W., Box 131, Garden Grove, Calif. 1946.
Stanley, Harold A., 2642 E. 222nd St., Long Beach 10, Calif. 1952.
Stanley, Willard F., Teachers College, State Univ. New York, Fredonia, N. Y. 1948.
Stanton, John S., Box 2495, Carmel, Calif. 1953.
Stauffer, James M., 144 S. Sawyer, Shawano, Wis. 1952.
Stebbins, Robert C., 601 Plateau Dr., Berkeley 8, Calif. 1939.
Steele, Paul H., Box 935, Sacramento, Calif. 1947.
Stein, Robert C., Laboratory of Ornithology, Fernow Hall, Cornell Univ. Ithaca, N. Y. 1951.
Stensrud, Clyde L., Rt. 1, Box 57, Atchison, Kan. 1947.
Stephenson, Ellen, 168 Cannon St., Hamden, Conn. 1952.
Stern, Ralph J. A., 305 Clay St., San Francisco 11, Calif. 1952.
Sterne, Marie E., 3027 Benvenue Ave., Berkeley 5, Calif. 1952.
Stettenheim, Peter, Division of Birds, Museum Zoology, Univ. Michigan, Ann Arbor, Mich. 1952.
Steusloff, Ivan, 245 N. 13th St., Salem, Ore. 1944 (1944) [L.].
Stevenson, James O., Fish and Wildlife Service, Dept. of Interior, Washington 25, D. C. 1928.
Steward, Orville M., Box 19, Fordham Dd. Sta., Bronx 58, N. Y. 1950.
Stewart, Paul A., 8640 N. State St., Westerville, Ohio. 1930 (1943) [L.].
Stewart, Robert E., Patuxent Research Refuge, Laurel, Md. 1941.
Stillwell, Jerry E., R. F. D. 2, Fayetteville, Ark. 1936.
Stitt, Merle E., Grand Teton National Park, Moose, Wyo. 1951.
Stockwell, Lillian M., 1114 Bay St., Alameda, Calif. 1954.
Stoddard, Herbert L., Sherwood Plantation, Rt. 5, Thomasville, Ga. 1914.
Stoerman, Frank A., 1721½ Westport Ave., Kansas City 2, Mo. 1952.
Stone, Edgar N., 55 Almaden Court, San Francisco, Calif. 1947.
Stone, Lois C., 1615 La Vereda Rd., Berkeley 9, Calif. 1946.
Stone, Ned W., 839 Galvin Dr., El Cerrito 6, Calif. 1939.
Stoner, Emerson A., 285 E. L St., Benicia, Calif. 1918.
Storer, Robert W., Museum Zoology, Univ. Michigan, Ann Arbor, Mich. 1941 (1952) [L.].
Storer, Tracy I., Dept. Zoology, Univ. California, Davis, Calif. 1910.
Stott, Ken W., Jr., Zoological Society San Diego, Box 551, San Diego 12, Calif. 1941.
Stowell, Mrs. Ellery C., 670 Santa Rosa Ave., Berkeley 7, Calif. 1949.
Strahan, Anna M., Box 293, Fort Klamath, Ore. 1951.
Straw, Richard M., Rancho Santa Ana Botanic Garden, Claremont, Calif. 1948.
Street, Phillips B., Exton, Pa. 1948.
Strehlow, Elmer W., 520 E. Montana St., Milwaukee 7, Wis. 1945 (1946) [L.].
Stringham, Emerson, Box 986, Kerrville, Texas. 1944.
Stuebgen, Sophie, 48 Highgate Rd., Berkeley 8, Calif. 1952.
Sturgeon, Jack, 203 Olympic Ave., Arlington, Wash. 1936.
Sturges, Franklin W., 1587 Brook Lane, Corvallis, Ore. 1951.

Suffel, G. Shumway, 1105 N. Holliston Ave., Pasadena 6, Calif. 1926.
Sumner, Lowell, % National Park Service, 180 New Montgomery St., San Francisco 5, Calif. 1924.
Super, Raymond R., 164 Maple Ave., West Manayunk, Philadelphia 27, Pa. 1952.
Suthard, James G., 1881 Raymond Ave., Long Beach 6, Calif. 1938.
Sutton, George M., Dept. Zoology, Univ. Oklahoma, Norman, Okla. 1924.
Svahe, Carl H., Frederikssündsvej 168, Brünshöj, Denmark. 1953.
Sweeney, R. D., 460 Las Palmas, Los Angeles 4, Calif. 1949.
Swinehart, Durward B., Jr., 2109 Juanita Lane, Sacramento 21, Calif. 1953.

T

Taber, Richard D., Dept. Forestry, Univ. of California, Berkeley 4, Calif. 1947.
Taber, Wendell, 3 Mercer Circle, Cambridge 38, Mass. 1935.
Taft, John E., 160 Eugenia Dr., Ventura, Calif. 1954.
Talmadge, Robert R., Box 71, Willow Creek, Calif. 1939.
Tanner, Vasco M., Brigham Young Univ., Provo, Utah. 1919.
Tapia, Guillermo J., Apartado Postal 2616, Mexico 1, D. F., Mexico. 1951.
Tashian, Richard E., Biology Dept., Long Island Univ., Brooklyn 1, N. Y. 1951.
Taylor, Lewis W., Div. Poultry Husbandry, Univ. California, Berkeley 4, Calif. 1931.
Taylor, Robert L., 810 Highland Dr., Pasadena 3, Calif. 1944.
Taylor, Trevenen J., 301 Sixth St., Davis, Calif. 1953.
Taylor, Walter P., 425 W. Harrison St., Claremont, Calif. 1905.
Teachenor, Dix, 1020 W. 61st St., Kansas City 13, Mo. 1922.
Teale, Edwin W., 93 Park Ave., Baldwin, L. I., N. Y. 1947.
Terres, John K., 345 E. 57th St., New York 22, N. Y. 1947.
Terry, Anne B., 1940 Waverley St., Palo Alto, Calif. 1937.
Test, Frederick H., Dept. Zoology, Univ. Michigan, Ann Arbor, Mich. 1936.
Tevis, Lloyd P., Jr., Box 1416, Carmel, Calif. 1940.
Thatcher, Vernon E., 210 Beatty St., Medford, Ore. 1945.
Thomas, Cedric, 12196 Laurel Terrace Dr., North Hollywood, Calif. 1954.
Thomas, Evelyn H., Apt. 1, 407 E. Pasadena St., Pomona, Calif. 1940.
Thomas, Gerald B., 3339 W. 82nd St., Inglewood, Calif. 1949.
Thomas, Ray, 600 Sarbonne Rd., Los Angeles 24, Calif. 1953.
Thompson, Arthur R., 12933 N. Hoover St., Los Angeles, Calif. 1952.
Thompson, Myrtle S., 260 Orange St., San Bernardino, Calif. 1938.
Thompson, William L., Museum Vertebrate Zoology, Berkeley 4, Calif. 1953.
Thomson, David H., 1335 Foothill Blvd., San Luis Obispo, Calif. 1948.
Thomson, Isabel A., 5939 Shafter Ave., Oakland 18, Calif. 1919.
Thomssen, Sylvia L., 56 Avon Rd., Berkeley 7, Calif. 1952.
Thornburg, Ashley A., 307 S. Wheeler St., Victoria, Texas. 1949.
Thornburg, Mrs. R. J., Rt. 9, Box 974, Tucson, Ariz. 1952.
Thorne, Oakleigh, II, Box 347, Islip, L. I., N. Y. 1947.
Thorson, Thomas B., Div. Natural Sciences, San Francisco State College, San Francisco 2, Calif. 1953.
Tillotson, Daniel F., 1820 Alray Dr., Concord, Calif. 1943.
Tinkham, Ernest R., Box 306, Indio, Calif. 1942.
Todd, David W., III, 1815 Magnolia Way, Walnut Creek, Calif. 1951.
Todd, Henry O., Jr., 106 E. Main St., Box 259, Murfreesboro, Tenn. 1946.
Tomich, P. Quentin, Dept. Zoology, Univ. California, Davis, Calif. 1943.
Tordoff, Harrison B., Museum Natural History, Univ. Kansas, Lawrence, Kan. 1951.
Townes, George F., 500 Sumner St., Greenville, S. C. 1953.
Trask, Parker D., 240 Southampton Ave., Berkeley 7, Calif. 1934.
Trautman, Milton B., Stone Inst. Hydrobiology, Put-in-bay, Ohio. 1946.
Traylor, Melvin A., Jr., 759 Burr Ave., Winnetka, Ill. 1950.
Treichel, George W., Jr., 887 Indian Rock Rd., Berkeley 7, Calif. 1950.
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Trost, Henry, 2344 Ulloa St., San Francisco 16, Calif. 1924.
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Walsh, David, 1520 Hill St., Ann Arbor, Mich. 1951.
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Wilson, Paul T., Box 582, Kentfield, Calif. 1937.
Wilson, Wynn A., 817 Green St., Fort Worth 3, Texas. 1951.
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